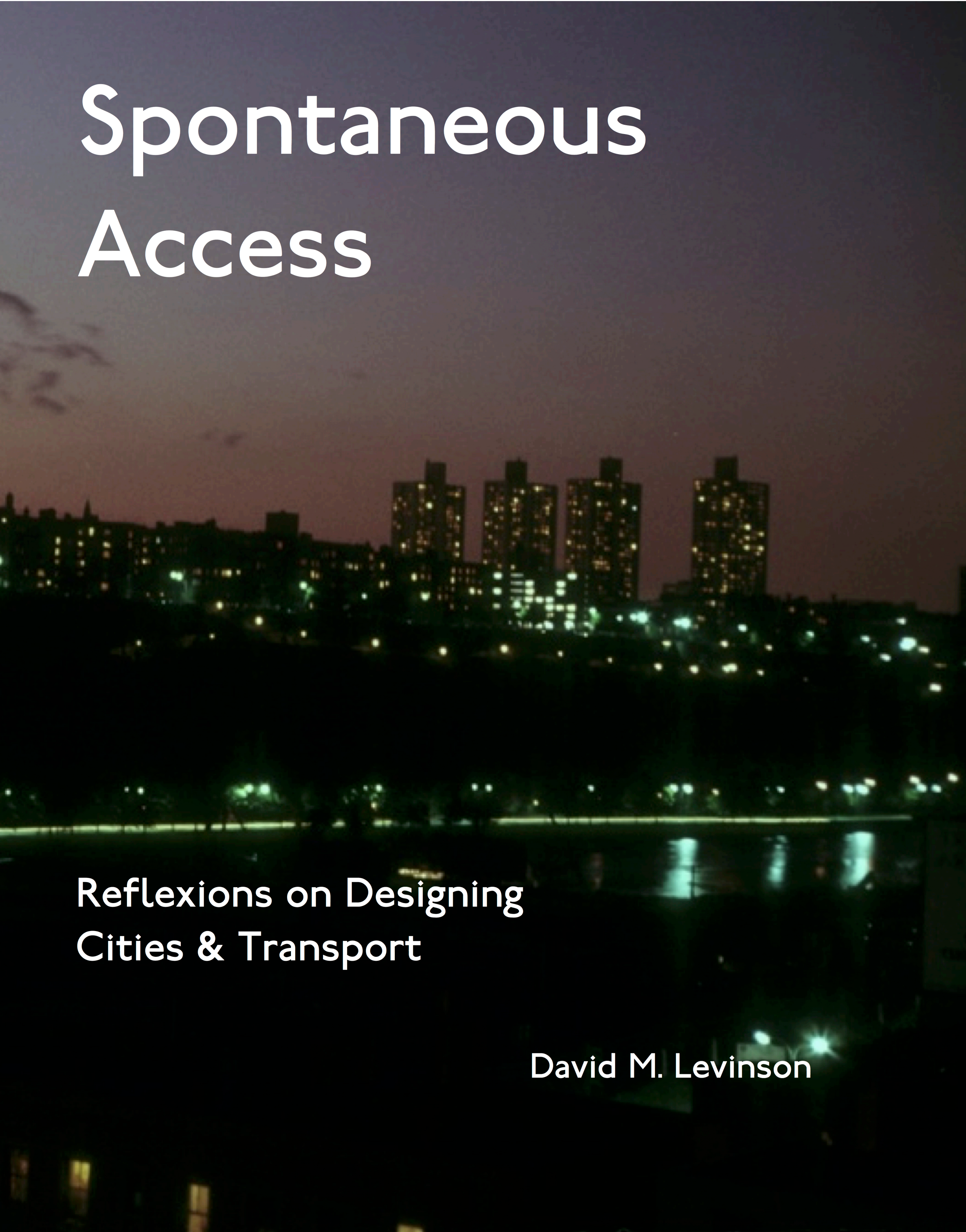
Spontaneous Access

Reflexions on Designing Cities & Transport

David M. Levinson



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Preface

I grew up in Columbia, Maryland, a highly planned new city from the 1960s. As I was constantly reminded in the promotional literature, it was a better place to live with fewer problems than unplanned sprawling suburbs or the decaying inner city.[1]

Living in the Next America sparked an interest in city planning, and after some diversions into electrical engineering, including a stint as a co-op student-worker at Hayes Microcomputer Products (the modem company), I returned to planning by way of civil engineering. I did a year of grad school in city planning at Georgia Tech and took a summer job in Silver Spring, Maryland at the Maryland-National Capital Park and Planning Commission – Montgomery County Planning Department (MNCPPC-MCPD – they didn't hire you unless you could say that abbreviation five times fast). They hired me full-time as a planner to work on the transportation model, so I dropped out of planning school.

Columbia, like most suburbs, was sterile – nothing was out-of-place. It differed from suburbs in scale, some 14,178 acres (57.38 km^2), and in orderliness.

Not just the housing, but the schools, retail, and offices and industry were all where they belonged, i.e. where the planners put them. Like most suburbs (and frankly most cities), everything closed on time (9 pm) aside from a few pubs (very explicitly no bars, and not until Columbia had come of age (well, turned 10) were pubs allowed), night clubs, and movie theaters.

Was there a way to gain the benefits of Columbia without its costs? Can we build a better city with appropriate, but not stifling planning regulation? Can this be decentralized, or more precisely, what is the most appropriate mix of centralized and decentralized decision-making?

Spontaneous Access, while it can be read in isolation, is one volume of a set of books on transport. The theme echoes that of a 2007 book I wrote with Kevin Krizek: *Planning for Place and Plexus: Metropolitan Land Use and Transport*.

Much of *Spontaneous Access* is drawn from my blog *The Transportist*, `http://transportist.org/`. or *streets.mn*, `http://streets.mn/`. although it has been significantly edited and reorganized from posts that may have appeared there. The `http://transportist.org` blog was previously known as the `http://transportationist.org`.

[1] (Levinson, 2003)

An alternate title for this book was *Designing Networks and Nexus*. In a sense, both titles refer to the same thing, the relationship between places (nexus) and networks (plexus). *Place and Plexus* discussed some of the ideas presented here, in later chapters, but did not focus on them. NEXUS is also the acronym I gave to my research group on Networks, Economics, and Urban Systems. The word network describes 'any interconnected group or system,' while nexus describes 'a form of connection, a connected group, the centre of something.' A nexus is a particular connection, which may be found at the center or core of the system, while a network is a set of connections.

The title is apt as we are dealing with networks that operate over physical space and time, where spatial and temporal relationships between network elements shape their use and form. The location of activities also gives obvious shape to the network, and the configuration of the network dictates what activities will be located at what places. The schedule of activities dictates the use of the network, and thus the capacity that is required to achieve a particular quality of use.

Planning for Place and Plexus views the world focusing on the idea of agency, and the relationships between agents, who may be travelers, firms, or governments. It thus aims for developing a positive understanding of cities and their networks do work. *Spontaneous Access* considers in more depth the physical network underpinnings that shape, and are shaped by, the relationships between agents. It talks to the perspective of the central planner/engineer/architect who is designing systems to serve users, by examining the world from the perspective of an informed user. It provides a worldview which complements that described in other books, but also goes more in-depth into normative design principles.

The Transportation Experience: Policy, Planning, and Deployment with Bill Garrison guides the reader to how transport systems came to be, but can really be thought about as macro-transport. That work sets the stage for *Spontaneous Access* which is far more micro in its approach.

It differs from two earlier works. The first, *Financing Transportation Networks*, based on my dissertation *On Whom the Toll Falls*, examined issues about how to pay for roads, and considered the tradeoff between taxes and tolls. It described that choice as endogenous to the question of jurisdiction size and the amount of inter-jurisdictional travel. Resources are a critical factor in this book. Understanding money flows is not independent of the design decisions we make.

The second, *Evolving Transportation Networks*, with my brilliant student Feng Xie, examined how networks grow and co-evolve with cities. Networks and technologies have trajectories that are broadly independent of individual decisions. But the devil is in the details. Technologies that worked well in one place don't in another, and that is in part a question of implementation and contextualization of the design. As the well-quoted philosopher Anonymous said:

> "In theory, theory and practice are the same, in practice they are not."

There are several themes in the book.

Cities and their networks operate on multiple timescales simultaneously. Traffic lights change by the second, rights-of-way last millennia. Cities see massive daily flows of people in and out. The core, timeless, enduring elements contrast with the faddish ephemera that too much effort is focused on. The future is emerging, but determining what we are looking forward to will be enduring or ephemeral should be the critical focus of anyone involved with transport and city design.

This book does not shy away from the normative and prescriptive. In this it differs from much academic work, including my own, which tends to the positive and descriptive. Principles are laid out, which I believe to be true and correct, many of which are not scientific in the way they are framed. They of course may lead to testable hypotheses, but they are also value-based.

The idea of the 'spontaneous city,' one that serves needs and wants in real-time, is a theme running through both the title and the text. What conditions encourage people to take advantage of their city (and therefore make it stronger)? What conditions worsen life for the users of the city?

The emergence of new transport technologies gives us a chance to restore and correct, to right what is wrong with the places we live. From the railroad and electric streetcar creating separation between places where people lived and where they worked, to the elevator enabling high rise construction, to the motorcar which put suburbanization into overdrive, all significant transport innovations reshape cities. The new autonomous vehicle, the new electric vehicle, the new shared vehicle, the vehicle form, shape, and size are a transformation of similar scale and scope. These changes will create opportunities over the coming decades, which we can seize or reject.

This book is about how cities do work, how cities can work, and how cities should work. In part it is about traditional fields of planning and engineering, but takes a much broader concept of design principles than those fields usually do. This is because it is also about evolution and it is about opportunism. The world is changing fast. We can make it a more humane place than it has ever been, or we can allow it to devolve into a more brutish environment, where we remain a victim of our

collectively built environments, rather than their master.

When the book speaks of 'cities' it really means the entire metropolitan 'urban system,' not just the historic core city (or the central business district). Downtown is but a part of the city, and the central city in many metropolises is neither a plurality of residents nor workers.

Much of this book includes complaint, and it may feel like shouting into the wind. But every complaint is about a design failure, either with intention or by accident, that degrades experience for everyone, or degrades the experience of some for the benefit of others. Life is comprised of tradeoffs, but not all tradeoffs are made at the appropriate rate of exchange. Both cities and their transport networks are the product of thoughtful human actions and unconscious emergent processes, where systematic behavior drives the underlying logic of designs.

The optimal design of transport networks to serve the goal of spontaneous access cannot be determined in the absence of knowledge about the actual development pattern. The optimal development pattern cannot be known without regards to the plan of the network. Discovering the right combinations of networks, land use, and other urban features is what makes cities successful. The measure of their success is their population, their wealth, their happiness.

But even more importantly, the optimal transport network for the technology of one era is not necessarily the optimal network of the future, and the same is true for development.

1
The City Spontaneous

Figure 1.1: Petticoat Lane Market. Photo by author.

Originally published as Levinson, David (2007-07-13) The Spontaneous City and (2007-03-16) London's Only 24-hour pharmacy.

Shortly after our daughter Olivia's birth in March 2007, my wife required a breast pump. This is common for new mothers expressing milk, but we were in the UK and our pump was in the US, and incompatible due to differing electrical standards in any case. While pumps are not terribly rare, they are medical devices and could only be acquired in real-time at a pharmacy. It was a Sunday evening, about 7 pm. In the US the 'I want it and I want it now' culture

has produced a 24-hour/7-day-a-week/52-week-a-year expectation of availability of just about anything, including pumps.[1] London, despite some surface similarities, is no Minneapolis. We were to find that all of the typical drug stores: namely Boots the Chemist and Superdrug were closed, not merely on our local High Street in Putney, but everywhere.

[1] In the US, 24 hour on-demand carpet installation is available.

Fortunately, the Internet informed us that Zafash Pharmacy, London's only 24-hour pharmacy, on Old Brompton Road near Earl's Court was open. From our Putney flat, I took the 22 bus there, got the goods, and returned on the 74 and 22 buses, with a total time of 67 minutes door-to-door-to-door. Google Maps put the distance at 3.4 miles via road, and said it would take 8 minutes by car ... there is not a chance this would have been true, even at 7 pm on a Sunday night. Along the way I encountered (and avoided) large numbers of drunk local footie fans coming from a Chelsea match, played nearby at Stamford Bridge.

Can it possibly be that London, England, a city of 8 million people, has only one 24-hour pharmacy? For a city that is a contender for 'capital of the world,' this is surprising. One could talk about Zafash, run by immigrants or maybe 2nd generation Londoners who have a unique entrepreneurial spirit, and how great that is. Still, it would be par for the course in the US. In my mind the question isn't why they are open, but why the others were closed.

Perhaps regulation has something to do with it, I don't know the extent to which neighborhoods have imposed zoning regulations limiting hours of operation, but restaurants and pubs could somehow figure out how to be open, despite their extra noise. Perhaps it is the costs of paying overtime. Perhaps is is the draining of the entrepreneurial spirit in this home to capitalism. Perhaps it is collusion, since if they are all closed, you will just have to shop when it is convenient for the chemist, not for you.[2] In contrast, US pharmacies are in fierce competition with supermarkets (which have been 24 hours in many locales for a couple of decades now, starting since they were doing overnight stocking anyway).

[2] This is the reason that auto dealers are closed on Sundays in Minnesota by state law, it is not that auto dealers are particularly pious, it is that you will buy a car anyway, so why make it convenient.

While I could understand why the local stationers isn't 24 hours, paper is seldom an emergency item, drugs and medical equipment are. In addition to being bad for customers, it seems that business here is leaving money on the table.

Cities enable spontaneous action. In its strongest form, the ability to engage in 'spontaneous action' is the ability to do whatever, whenever. The phrasing might imply exciting and entertaining things: going out to a concert or a ballgame, playing

parkour, kayaking on a river, or robbing a bank, but most things are quite mundane, from getting a pint-of-milk to going to the apothecary.

Spontaneous action requires at least two elements.

1. **The presence of things to do.** The thing must be where I want it to be, and it must be open or available when I want to use it.

2. **The ability to reach those things.** I need to have a means of transporting myself conveniently from where I am, to where I want to be, when I want to go there. In short, there must be both destinations and networks that satisfy action.

In the real world, spontaneous action is limited to what others are willing to allow or accommodate. The world, fortunately, is no Springfield 'Do What You Feel Festival.'[3] There are many things, that for technical or economic reasons, I cannot acquire, and many activities I cannot engage in because they do not exist. Others are prohibited by law or custom, like robbing a bank, and thus have a high likelihood of imposing penalties I might not want, like attending prison or being transported to a foreign land. Others are simply discouraged by reputation effects, and the desire to not only do what I want today, but to retain the option to do what I want tomorrow.

[3] The Simpson's Episode Season 5, Episode 7: "Bart's Inner Child." Following a self-help guru, the town of Springfield decides to act like Bart, disaster ensues.

There are many locations that have networks, and people who have vehicles, that allow them to move about easily. In any small town or rural area, someone who has a car can easily move about, but there is, from the big city perspective, nowhere to go. These areas have high mobility.

Some places have lots of activity, most notably high density cities. However because of crowding it may be difficult to move around very much, these places may be congested, limiting the speed and comfort of travel.

In the best cities, there are many places to go and things to do. In those cities, the network is constructed with appropriate differentiation so faster and direct links connect dense places. The relatively slow speed of large cities (compared with suburbs or rural areas) is compensated for by the short distance, so that these areas have high accessibility.

DIFFERENT PEOPLE WANT DIFFERENT THINGS. If we all wanted the same things, life would be pretty boring. Still accessibility is something that almost everyone does want, though everyone also has a limit to how much money and time they will pay for it.

Places with higher accessibility allow more spontaneous action than places with lower accessibility. Land prices are higher in places with high accessibility both because of the scarcity of such places and their value.

Figure 1.2: 'High Stakes' a bookstore specializing in books about gambling in London, England.

There is a premium to be paid for the ability to engage in spontaneous action. In economic terms, this is an option value that people hold. Even if they never go to a club, or a show, or a game, or the museum, or the local dairy store, or the particular specialist shop (like the bookstore specializing in gambling books I found in London, in Figure 1.2), accessibility gives them the option of engaging in that activity.

One opposite of spontaneous action is scheduled action. If I cannot engage in things when I want, I must plan in advance when to do them. This may be because of other people's constraints, or limitations to the transport system, or hours of business of the thing I seek. The advantage of a large city is the increased flexibility, the high frequency of transit services, and the increased likelihood of finding a 24-hour store specializing in what you seek (London's lack of 24-hour services notwithstanding).

New technologies make on-demand travel and activity easier. Without requiring the night bus and night train, mobility-as-a-service, ranging from taxis to car-sharing, to a future with cloud-commuting based driverless cars, relaxes many of the temporal constraints of travel for the carless. Automation enables stores and services to be available 24 hours a day. One can imagine going to an unstaffed corner shop and being able to buy goods pretty easily. More futuristically, online purchasing (via voice control) with robotic or aerial drone deliveries make the acquisition of stuff easier.

Yet automation still has limits. Meeting of random people at a place requires other people to be there. Meeting specific people requires engaging in the frictions of pre-planning and coordination. But with apps for social connection with both friends and strangers, spontaneity reigns.

2

The 60-Year Line

Figure 2.1: Map Showing the Lines of the Twin City Rapid Transit Co. Minneapolis and St. Paul 1904.

Originally published as Levinson (2014-10-23) The 60-Year Line.

Look forward by looking backwards.

Assuming we started with an undeveloped wilderness, or even semi-developed agricultural areas, cities emerge at selected points, usually with natural or man-made accessibility advantages over their neighbors, such as harbors, or waterfalls, or railroad junctions. But they evolve from wilderness to city over time.

They do not generally evolve because someone built city-scale transport out in the country and waited for the people to arrive. Instead it is a ratchet: a few people, some transport network investment; some more people, more investment; even more people, still more investment, and so on, until something resembling a city emerges.

While the infrastructure may slightly lead the development at some points in time, as in the United State's streetcar suburbs or London's Underground, those developments in general contiguously extended the urban environment in appropriate steps, and were accompanied by development in the near term. (Levinson, 2007; Xie and Levinson, 2009). Failure to see development in short order would have led to bankruptcy for the line.

Today, we often build lines that aim to promote development. That is, the infrastructure serves non-places in the hope they become places. The evidence on this is mixed. Sometimes transit

lines successfully promote development, sometimes they don't. Sometimes highways encourage economic development, sometimes they don't.

If infrastructure were privately built (as in times of yore), this would be much less of public policy question, as the public is not bearing the financial risk. That is not to say there are no policy questions, the line-builder wants right-of-way, and that often requires eminent domain powers and public consent.

However lines are now publicly built in the vast majority of cases. The public is bearing the risk so that the privately owned lands might appreciate in value, and the public might get a small share of that increment. General tax revenues are not nearly enough to justify the line, since lines are expensive. In a mature network all the good lines, the low-hanging fruit, have been built, and most development is a transfer from one place to another. The risk is the capital outlay will not be recovered from future revenue (from users or non-users). In contrast, building lines where people actually are, where demand currently exists, presents much lower risk in revenue projections.

Lines typically last upwards of 60 years with a given technology. Streetcars in the Twin Cities lasted from 1890 to 1954 or so. We certainly cannot predict 60 years into the future. As of this writing, 60 years ago was before both the Shinkansen and the groundbreaking of the Interstate Highway System. Predictions from 60 years ago about today were not terribly accurate.[1]

[1] Sixty years is longer than Kondratieff's long economic cycle describing the lifecycle deployment of technology. (Kondratieff, 1979).

Will today's places have any activity in 60 years? A good test of that is whether the place had activity 60 years ago. Look at the map of 60 years ago. Where was the activity? Where is it today? The intersection of those two maps show places with proven longevity. There are no guarantees those places will have activity in 60 years of course (as they say in financial prospectuses 'past performance is no guarantee of future results,') but they are more likely to because there is an underlying cause for the stability of the place. That is, there was a cause for that place to develop in the first place, such as a useful waterfall, a port, or a junction between intercity rail lines, and the positive feedback structure between transport, spontaneous access, and land use actively worked to reinforce the strength of that place.

3
Community without Dendricity

Figure 3.1: The People Tree of Columbia, Maryland.

Originally published as Levinson, David (2016-06-29) Sometimes a city is a tree.

PEOPLE USE CITIES IN UN-ENVISIONED WAYS.

In a brilliant and widely-cited essay: 'A City is not a Tree.'[1] Christopher Alexander criticizes new towns, notably my hometown, Columbia, Maryland, for being treelike (dendritic) in conception, rather than what he terms a semi-lattice, or mesh-like, network. Columbia's symbol, ironically enough, is the People Tree shown at the beginning of the chapter. Columbia's neighborhoods belong to

[1] (Alexander, 1968).

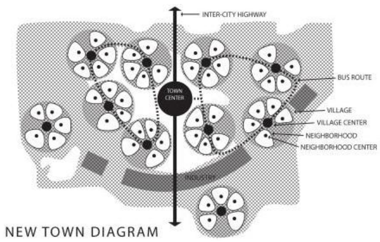


Figure 3.2: Map of Columbia, Maryland New Town Diagram of 9 village 'community pods' for the New Town of Columbia, Md. Planned and developed by the Rouse Corporation with Howard Research & Development Company, 1962-67. Showing village centers, neighborhood centers, and the Minibus system connecting the villages and Town Center. Redrawn by Amber Wendland based on original by Mort Hoppenfeld.(Wendland, 2013).

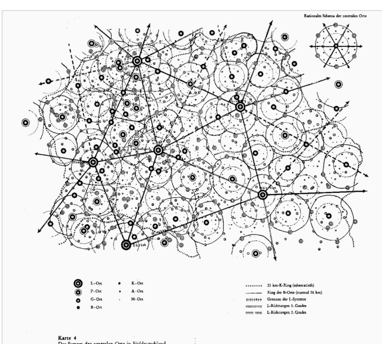


Figure 3.3: Central Places in Southern Germany, by Walter Christaller.

her villages, the villages are part of the city. The neighborhoods, following an element of the classic plan of the pioneering community of Radburn, New Jersey, are isolated and hierarchical, that is, by design, one is not supposed to be able to go from one neighborhood to another without being on a village street. Neighborhoods are filled with cul-de-sacs, on which most homes lie. That's not to say there is no through traffic; there is, because the neighborhood network has more than one outlet.

But it's not simply the street network that is treelike, retail is also treelike. The neighborhood center might have a convenience store selling pints-of-milk, comic books, cigarettes, and bubblegum (Seven-Eleven or Wawa), the village center would have a grocery and 10-20 smaller stores. Town Center had the Mall in Columbia with department stores and over 100 shops.

Finally the schools were hierarchies. The neighborhood elementary school was intended to directly feed the village-level middle and high schools.

Perhaps Walter Christaller would be proud that Central Place Theory was not merely descriptive, but also prescriptive.[2]

In practice the use of the city was not so treelike, and far more spontaneous. As a resident of the neighborhood of Bryant Woods in the Village of Wilde Lake, my mom could go grocery shopping at a Safeway at Joseph Square shopping center in the Village of Harper's Choice or a Super Giant in the Village of Owen Brown which was larger than the no-longer-so-giant Giant of Wilde Lake. It was only another mile or two down the road.

Later, as a resident of the Longfellow neighborhood, in the Village of Harper's Choice, I could open-enroll into Wilde Lake Middle School instead of the assigned (but geographically no closer) Harper's Choice Middle School. And of course not every neighborhood got an elementary school, not every village got a middle or high school, and the boundaries were overlapping. So while the stylized schematic drawing may have looked treelike from the perspective of an architect a few thousand miles away, it was not treelike in practice on the ground.[3]

I don't believe Columbia's planners envisioned it would be so tidy – though perhaps better to start out tidy and let entropy emerge rather than start out chaotic and hope the city self-organizes into an aesthetically pleasing environment.

Rather my impression from reading early planning and promotional documents and having lived there and hearing talks from officials of the developer (Howard Research and Development (HRD), a subsidiary of shopping center developer The Rouse

[2] (Christaller, 1966; Vance, 1990; Pred, 1977).

[3] See (Levinson, 2003) for my take.

Company), including Columbia resident Jim Rouse himself, is that they believed that treelike street networks reduced through traffic, just as planners favor traffic calming today. They believed shopping should be organized into centers, rather than sprawled out uncontrolled along streets, and they should be spaced to be closer to residents to reduce travel costs. They believed local government is somewhat hierarchical (national, state, county, city) and that the village was an organizational unit that had some value to regulate things such as architectural covenants, that were too microscopic for the city as a whole.

In fact, Columbia is not technically a city, it's just a homeowners association, though it is a Census-Defined Place and the second largest in Maryland, after Baltimore, just as was foretold by planners in the 1960s. Columbia's planners believed kids should walk to their neighborhood school, so the neighborhood should be the right size to support the school, which should have some 500 students for pedagogical and cost-efficiency reasons. Ideally students would walk to their middle and high school too, but middle and high schools would be larger to offer students choice. So the hierarchy was a natural organization.

Clearly social connections should not be assumed to flow in a way that maps directly to the physical layout of the network. Tobler's Law,[4] which says all things are related but near things are more related than far things, means all other things being equal, you are more likely to know your neighbor than a randomly selected person farther away, and my mom was more likely to shop at the Wilde Lake Giant than the more remote Owen Brown Super Giant. However there are far more people farther away than who are your neighbors. In a modern world with migration and telecommunication, you are likely to know someone specifically who is not on your block and to not know everyone on your street. Growing up, my mom's friends in Columbia Jewish Singles were scattered across Columbia, not just in her neighborhood.

The expression 'Community without propinquity' was coined by Berkeley Planner Mel Webber,[5] who is credited with influencing the design of British New Town Milton Keynes. 'Propinquity' is a fancy college entrance exam word for nearness, and the idea was that people establish communities with others who are not their immediate neighbors, something that is obvious in the Internet age, and less so in the early 1960s. This idea applied in Columbia as it does everywhere, where people could meet based on any kind of interest, not simply the desire to live on the same street.

[4] (Miller, 2004; Tobler, 2004).

In fact membership in Columbia Jewish Singles would include people elsewhere in Howard County, including Columbia's outparcels. Outparcels were properties never acquired by Columbia's developers and so not in the homeowners association, a fact known to the homeowners who had lower taxes/assessments, but not otherwise detectable aside from different color street signs.

[5] (Webber, 1963).

'Form ever follows function,' propounded famous architect Louis Sullivan when describing how buildings should be built. But he was not addressing what happened after the building was built. Instead we might say:

Function need not follow form. In fact, the physical form of the city does not *represent* how the city functions, but more importantly the plans do not *determine* how the city works. People and their relationships are affected by their environment, but reshape it to suit their needs.

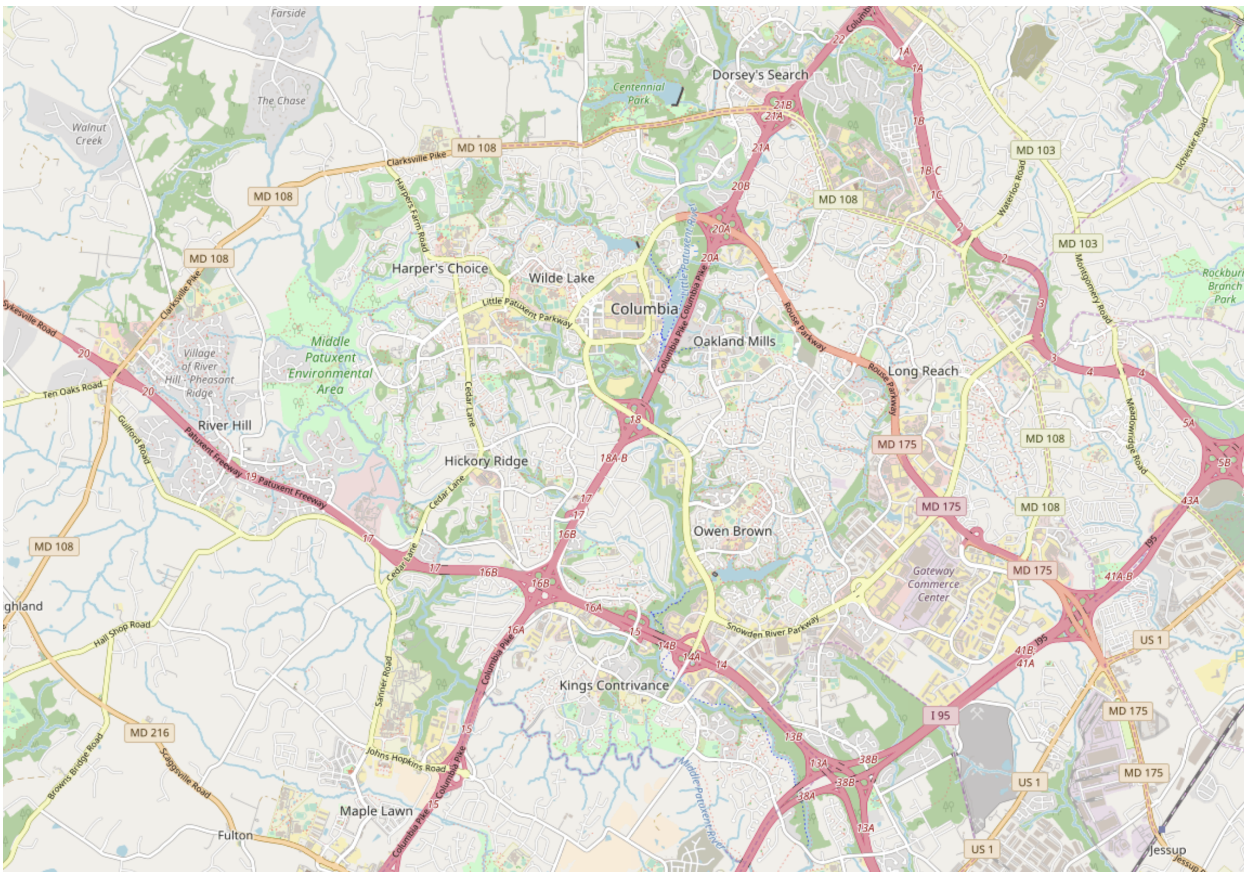


Figure 3.4: OpenStreetMap.org map of Columbia, Maryland, as built (2016).

4
The Pint-of-Milk Test

Figure 4.1: 7-11 convenience store in Columbia, Maryland.

Originally published as Levinson, David (2013-02-25) Just in time consumption: Does the 'pint-of-milk' test hold water?

Daily needs should be easily accessed

Just-in-time production revolutionized manufacturing, enabling both a reduction in inventories, as supplies arrive only shortly before needed, and an improvement in quality, as inputs are no longer stored for long periods of time. Manufacturing problems can be quickly identified and feedback provided to the supplier. The widespread adoption of the just-in-time process is itself the product of the logistics revolution, information and communications technologies, containerization in shipping, and the modern freeway system. It has seen a concomitant change in the retail sector, which has brought about fewer and larger stores at a greater distance from

the end consumer.

The notion of 'just-in-time consumption,' (acquisition of a good by the end consumer shortly before its use, rather than being acquired and stored for future use) though seemingly a natural mirror to the more widely used 'just-in-time production' has not received the same attention, but is critical to the success of the spontaneous city.[1]

[1] The phrase itself, as of 2013, only generates 212K hits in Google, (significantly higher than 2007, and of which the original version of this post rates #2) of which only a few are on-point, in comparison to over 2.23M for 'just-in-time production.'

Many goods and services are already consumed in a just-in-time manner. Most notable is energy, which is delivered on-demand to users, who no longer store coal at home for the furnace, but instead buy natural gas or electricity as needed. (The slowly vanishing home heating oil remains an exception). Other services that are provided on-demand or just-in-time include water and sewer, and communications (internet, telephony, and television). What is common about these disparate technologies is their network nature, the large infrastructure required to enable using the flows on-demand. While sewer is a continuous service for most people (those who do not have septic tanks), garbage is typically only collected periodically (e.g. once a week), and recycling less so (e.g. fortnightly). Processes are getting more efficient over time, and the same output can be provided with much less input.[2]

[2] (Herman et al., 1990; Wernick et al., 1996; Heiskanen and Jalas, 2000).

Other goods once saw regular to-the-house delivery, especially in suburban areas. Foxell (2005) writes:

> 'This service economy is illustrated by the variety of tradesmen that called at our home: the milkman twice a day, with a horse-drawn cart; the baker once a day, with a large upright barrow on two wheels, the handles of which lifted him off the ground when going down hill; the postman thrice; the butcher's boy by bicycle twice a week; and the grocer twice a week. Others like the coalman or the Gas, Light & Coke Co. in their steam-powered Sentinel lorry also made regular deliveries. Over a longer period, visits could be expected from the men from the Prudential [insurance], Hoover [vacuum cleaners], Singer [sewing machines] and the like – all using a service call to take the opportunity to sell new products. There was something reassuring about seeing such familiar faces and catching up with the latest gossip. In addition there were the itinerant callers such as Walls Ice Cream man on his tricycle as well as the French onion sellers, gypsies with pegs and posies, rag and bone men, tinkers [metalsmiths] and the knife-sharpeners with their pedal-driving grinding wheels.' [3]

[3] (Foxell, 2005).

Today, the vast majority of those goods are not acquired at home but in stores or online. Delivery services have replaced salesmen, as the two functions (delivery and sales) are now distinct and specialized. Today's visitors might be the post office, FedEx, or UPS, a lost white van from an Amazon contractor, and the pizza delivery robot.

Just-in-time does not require delivery to the residence, it can involve ubiquity in the placement of stores, so that they are near the end consumer. Traditionally the retail store was just that, a place where a community could store goods, and individuals could take or buy them as needed. My mostly single-family home block in Minneapolis once had two small grocery stores, dating from the days before electrified refrigeration. Just-in-time provides a convenience to the consumer, so one might imagine a premium to be paid. But it may also be cheaper for the producer or distributor, who can then store less inventory.

Many planners would like to make the ability to acquire goods just-in-time without the use of a vehicle a normative planning standard. For instance, a UK report calls for the 'pint-of-milk test,' for all new developments, whereby a resident can get to a shop to buy a pint-of-milk in 10 minutes or less without getting in their car.[4] This aligns with the neighborhood concept of planned communities like Columbia, Maryland (see Chapter 3), as illustrated in the Figure 4.1 which shows one neighborhood convenience store within a few minutes walk of many residents. The store, a 7-11, originally was only open its namesake hours (begetting a competing chain of 6-12 stores in Montgomery, County, Maryland), but is now more typically 24 hours, expanding access.

[4] (Parliamentary Advisory Council on Transport Safety, 2007).

The idea of 10 minutes comes from people's willingness to walk, people are less willing to walk longer distances than shorter, and 10 minutes (or one-half mile (0.8 km)) seems to be a threshold over which walking tolerance seems to drop. This distance was derived from several empirical studies, which showed the median walk by travelers accessing the New York subway was 0.35 mi (0.57 km), while the median walk to access commuter rail stations in suburban New Jersey was 0.5 to 0.6 mi (0.8 - 1.0 km).[5] Results from the 1983/84 National Personal Transportation Survey found shorter distances: 70 percent of Americans will walk 500 feet (0.15 km) for normal daily trips, 40 percent walk 1,000 feet (0.31 km), and only 10 percent walk a half-mile (0.8 km).[6]

[5] (Pushkarev and Zupan, 1982).

[6] (Unterman, 1990).

The pint-of-milk refers to a standard quantity of a highly perishable and frequently consumed good. The objective of avoiding car use is obvious for a group advocating road safety. The pint-of-milk test has received some currency in England, being noted by several studies in recent years.[7] This is a particular issue in a crowded city like London, where auto ownership is lower than suburban areas, roads are more crowded, and parking more difficult even for those with a car.

[7] (Bennett and Morris, 2006; Marsh, 2004).

The trends in retailing have been clear in the United States for a

long time. Stores are getting larger and serving larger territories.[8] Small stores serving local areas have been losing market share to larger stores which bring with them economies of scale. Efforts to reverse this trend have met with resistance from retailers, consumers, and neighbors.[9]

Illustrating this trend, the Food Marketing Institute reports in 2006 there were 34,019 supermarkets (with $2 million in sales or more, noting the median annual sales for a supermarket was $17 million, and average size was 4525 m^2). The average number of trips per week consumers make to the supermarket was 1.9. [10]

In 1930, The Great Atlantic and Pacific Tea Company, at the time the leading US supermarket, alone had 16,000 stores with a combined revenue of $1 billion (or per store revenue of $62,500 in 1930 dollars, estimated to be $754,000 today)[11,12]

Handy (1993) argues

> 'the automobile instigated a collapse of the retail hierarchy by encouraging the growth of community and regional centers at the expense of local shops and the central business district. The result has been a cycle of dependence, in which suburban communities are designed for the automobile leaving residents little choice but to drive.'[13]

As with stores, houses too are getting larger over the long run. While urban residents export storage to common stores, suburban residents are more likely to possess second freezers, and with larger houses have more space to store stuff in-house.

If urban residents do undertake more just-in-time consumption than suburbanites both because of the higher storage costs associated with smaller houses, and the greater opportunity afforded by more stores nearby, we would expect to see this show up in the travel behavior data that is collected by urban regions.

Table 4.1 illustrates some of the differences between the City of Minneapolis, suburban Hennepin County (Hennepin excluding the City of Minneapolis), and the City of St. Paul in neighboring Ramsey County. Residents of Minneapolis live in older houses (average year

[8] (Yim, 1990).

[9] (Nelson and Niles, 1999).

[10] http://www.fmi.org/facts_figs/superfact.htm (now offline and found in Google cache; Sources: U.S. Department of Labor, U.S. Department of Agriculture, Progressive Grocer magazine, U.S. Census Bureau, and Food Marketing Institute.

[11] (Walsh, 1986).

[12] Conversion factor from (Williamson, 2007).

[13] (Handy, 1993).

	Minneapolis	St. Paul	Remainder of Hennepin Co.
Year Structure Built	1926	1929	1970
House Area in ft^2 (m^2)	1773 (165)	1826 (170)	2152 (200)
House Area per Person	822 (76)	755 (70)	810 (75)
Households with No Cars	5900	2800	2500

Table 4.1: Housing in Hennepin County, Minneapolis, and St. Paul.

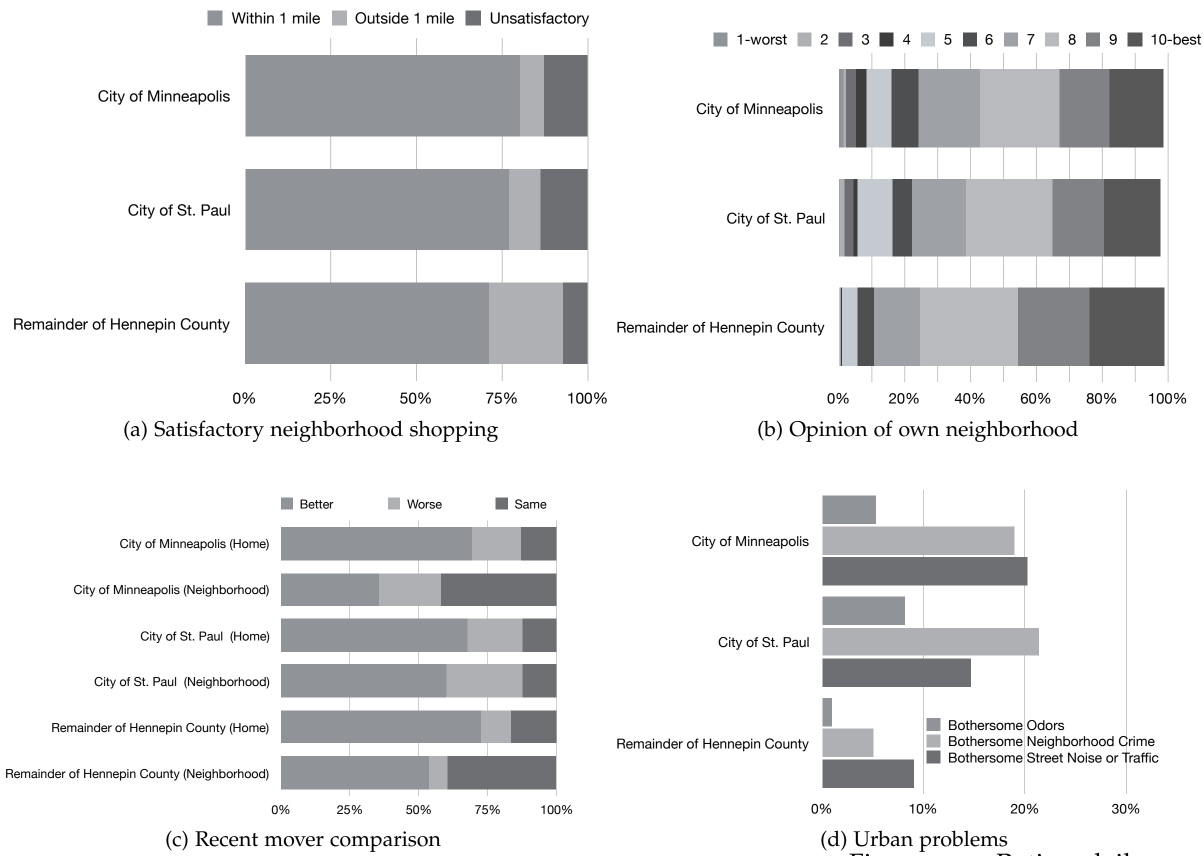


Figure 4.2: Rating daily needs. Source: (US Census Bureau, 1998).

built of 1926 vs. 1970 in the suburbs) with 1773 square feet vs. 2152 in the suburbs. However because of the lower household size, city residents actually have slightly more area per person.

Some additional data are illustrated in Figure 4.2. The evidence supports the hypothesis that city residents who have somewhat higher accessibility to neighborhood stores and somewhat reduced storage space at home shop more frequently (Figure 4.2a).

Despite that positive assessment of shopping, suburban Hennepin residents have a better opinion of their own neighborhood than those in the City of Minneapolis (Figure 4.2b). Over 80 percent of residents in the City of Minneapolis report satisfactory neighborhood shopping within a mile of home, compared with 70 percent of those in suburban Hennepin County (Figure 4.2c). The problems these urbanites report in greater numbers than their suburban counterparts are noise and traffic, crime, and odors (Figure 4.2d).

When people move, they are doing so to places they believe are better, but for all residents it is the home that is better than previous much more so than the neighborhood, and in Minneapolis, only a

third rate their current neighborhood as better than their previous (in contrast to half of suburban residents).

While the number of freezers per household in the United States is declining as second freezers are being retired and not replaced, the number of refrigerators is increasing slightly, due to households obtaining second refrigerators. (Wenzel et al., 1997) Though no immediate inference can be made about this, other trends are also at work. Total refrigerated and frozen space has not been computed, though casual observation of white goods stores says the average size of a house's primary refrigerator or freezer is increasing. Food may last longer in refrigerators than it used to due to the addition of preservatives (though the trend of increased consumption of organic foods may reverse this). Further globalization may mean that fewer goods are seasonal and need to be accumulated prior to their being out-of-season. E-shopping may induce the installation of a second set of fridge/freezers per household to receive delivered goods. (Persson and Bratt, 2001) This additional electricity consumption has environmental consequences; already, there are 2.2 refrigerators and freezers per household in New Zealand. Roke (2006) cited in (New Zealand Ministry for the Environment, 2006).

There are two types of places, those that satisfy the pint-of-milk test, and those that don't. Similarly, there are two kinds of people, those who care about the pint-of-milk test and those who don't.

The problem comes from the mismatch of those who care but live in places that are unsatisfactory. (Those who don't care but live in places passing the test are probably okay). If self-selection is at work, these cells are not randomly distributed, but people who want to live in particular environments do so. People who prefer milk-accessible areas bid up prices in those areas, while those who are indifferent (or perhaps lactose-intolerant) move out. However, if preferences change faster than spatial structure, there may be a mismatch. Further, my desire for acquiring milk in person creates a positive externality for you, as it makes it more likely you can acquire milk in person as well.

Policy that separates residential and commercial development like cream from milk may also foster a mismatch. To the extent neighborhood shopping enabling just-in-time consumption of the pint-of-milk is important to people, cities fare better than their suburbs, but if the cost of that neighborhood shopping is other urban ills, people will make the trade-off, sacrificing access to retail to have access to quiet and congestion-free, safe, and pleasantly smelling suburban environments.

Whether this is a social good is another question entirely, and depends on relative efficiency of urban goods delivery services, energy efficiency of in-store displays vs. at-home refrigeration units, and numerous other questions.

The future of retailing is up in the air.[14] Online shopping continues to increase market share, including new attempts at near-real time grocery delivery. While at the time of this writing (2016) most shoppers do not avail themselves of this model, 20 years ago, most people did not shop online either. New delivery models, enabled by robots and aerial drones will further lower the cost and increase the convenience of online shopping. Even more, new models of temporary lockers (mailboxes as drop boxes) may emerge to fill the gap.

[14] (Levinson and Krizek, 2007, 2018).

The point of this is that the access to the goods and services people require will expand in ways that are not considered in traditional measure of access. Instead of how many stores can I reach in 10 minutes each way, as illustrated in Figure 4.3, the

question might be how many stores can reach me in 20 minutes or an hour. And when the answer for almost everybody is 'almost all of them,' we will have come very close to universal accessibility to pints-of-milk and other goods that retail accessibility tests are supposed enable. Undoubtedly, when this is true, even fewer places will be able to meet the traditional pint-of-milk test, as some of the customers keeping those shops afloat and awash in milk will have melted away to be served by delivery, the modern day, perhaps robotic, milkman, instead.

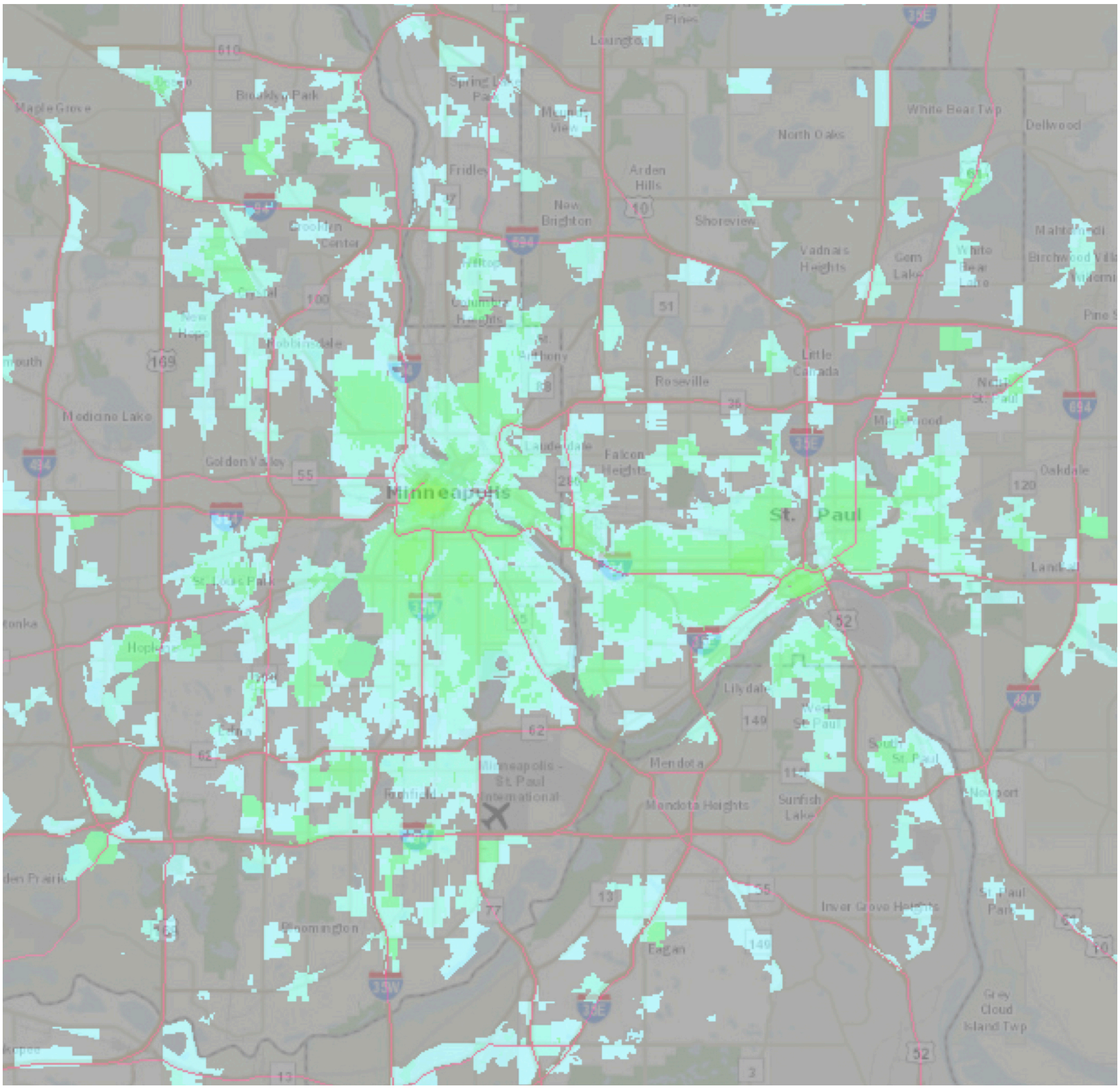


Figure 4.3: Pockets of walk accessibility in the Twin Cities region.

5
The Timeless Way of Building Networks

Figure 5.1: Timeless street. Photo by Jesse Vermeulen, posted at Unsplash.

Originally published as Levinson, D. (2016-05-23) The Timeless way of Building Roads.

TRANSPORT NETWORKS SHOULD SERVE THE PLACES THEY CONNECT, AND SHOULD NOT DESTROY THEM.

Noted architect and designer, Christopher Alexander, who wrote *The City is Not a Tree* also penned *The Timeless Way of Building*. He says the following:[1]

[1] (Alexander, 1968, 1979).

> 'There is one timeless way of building. It is a thousand years old, and the same today as it has ever been. The great traditional buildings of the past, the villages and tents and temples in which man feels at home, have always been made by people who were very close to the center of this way. It is not possible to make great buildings, or great towns, beautiful places, places where you feel yourself, places

> where you feel alive, except by following this way. And, as you will see, this way will lead anyone who looks for it to buildings which are themselves as ancient in their form, as the trees and hills, and as our faces are.'

In contrast, the great transport networks of the past skirted the local beautiful places. They were made by people detached from the places these links served. They had to be, as the networks connected many places, and aimed to do so efficiently. Though these network paths are ancient, modern roads are built upon the travels of earlier indigenous populations or even animal trails that emerged spontaneously. Following what may seem today to be obvious convenient corridors, these routes traded off the initial cost of construction for a reduction in long term travel times. Time savings measured often not in minutes per day, but millions and billions of minutes over centuries. Many of these routes connected timeless places with each other and went through wilderness or later farmland.

These higher level intercity arterial networks connected into the city and town with a fine-grained mesh of capillaries.

With the advent of the railroad, the automobile, and ultimately the superhighway, networks not only connected, they disconnected.

The British Parliament for instance stopped railways from entering the capital's historic business center, the City of London, for fear of it being carved into tiny pieces by routes coming from all parts of England. This led to the construction of the Metropolitan Line of the London Underground, which was first intended to connect all the intercity railway termini north of the city.[2]

[2] (Levinson, 2007).

Cities less wise than London found that networks disconnected timeless places with themselves, severing places and obliterating one community for the gain of other communities.

This modernist program contrasts with timeless earlier pre-industrial paths that did little to disrupt local communities (though there were the inevitable complaints about early turnpikes and canals as well). But once scale became relevant, removing local access in the name of removing local friction ensured there would be tension between the needs of the neighborhood, village, or town and the needs of the region. The road would not only benefit the region as a whole, it would specifically cost local residents, who would bear the costs of communities being divided (severance) and the outcomes of transport that the users of transport and their providers don't account for, like noise, pollution, and the potential for fire (in economic jargon, 'negative externalities'). Sometimes those costs came without any benefits at all, if no access to the new

transport corridor were provided.

This was certainly overdone, but that doesn't mean none of it was worthwhile. There is value in faster connectivity measured in travel time savings or land costs. Modern society would be impossible with the fast well-connected networks that facilitate the safe and efficient movement of people and goods. They enable a large scale of spontaneous action, bringing more activities within reach. It is harder to determine how much value was lost by forced relocation and breaking the fine-grained social and economic networks that had enabled then extant spontaneous action, in the neighborhoods torn asunder by the Interstate, like St. Paul's Rondo.[3]

[3] (Altshuler, 1966).

Many newer projects try to reduce these impacts, for instance by boring under rather than bulldozing through communities, (tunnels like Boston's Big Dig, Seattle's Alaskan Way, and Sydney's WestConnex are examples), but because of the new additional costs, these newer projects also are no longer efficient, their initial costs may never be recovered by future benefit, so we must question why they are constructed in the first place.

Transport corridors rarely bring joy. It is seldom that the journey is the reward. We certainly can do better in this regard, but we also must accept transport is a derived demand, and depends on the desire to go from one place to another. Destroying places to connect places is a strange way of achieving this end, but in the real-politic of planning, some places and people are more valued than others. It recalls everyone's favorite planning villain, Robert Moses, who said:

> 'If the End Doesn't Justify the Means, What Does?'[4]

[4] Quoted in: (Caro, 1974).

Figure 5.2: Wuhan, China is undergoing rapid transformation. How it adapts to motorization depends on whether it bends the city to the car or the car to the city.

6
Axioms about Roads

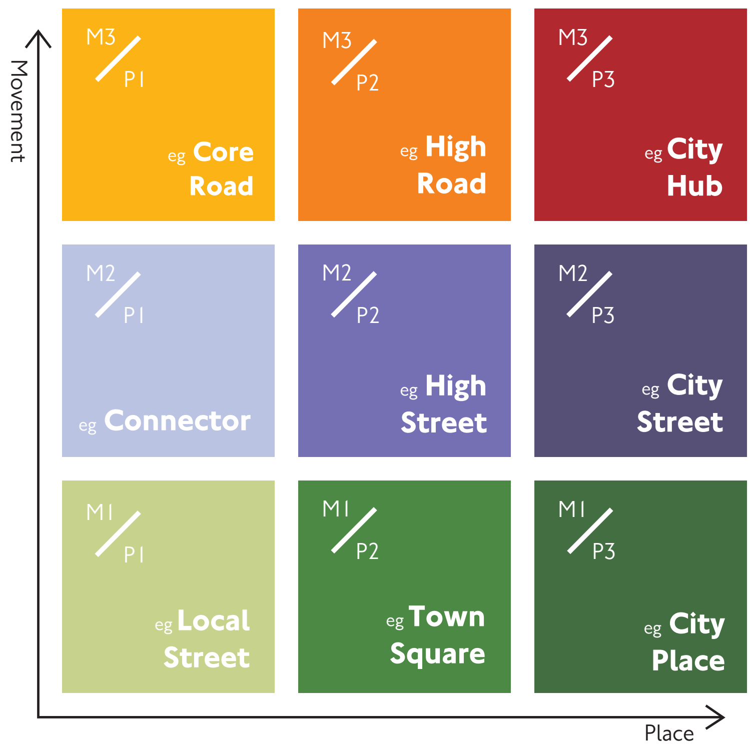


Figure 6.1: Streets types matrix from Transport for London looking at tradeoff of Movement and Place.

Originally published as Levinson, David (2016-06-28) The Hierarchy of Roads: 7 Axioms on Street Design.

Different roads serve different goals. two purposes, as illustrated in Figure 6.1. One is access to land. I need a street in front of my property to get to and from my property (otherwise I am landlocked and require aircraft, tunnels, or boats). This street in residential areas is designed to be relatively slow moving, allowing travelers to reach their final destination (or leave their origin).

The second purpose is movement, I want to be able to go long distances between places at a low cost (time, money, etc.). Roads designed exclusively for this purpose include interstate highways, which are grade-separated and limited access.

The problem lies especially in roads that serve dual purposes, where non-locals want to move quickly, while locals want people to move slowly (or better yet, not at all except for the locals). Managing these tensions requires creative solutions.

This chapter presents some axioms about the modern hierarchy of roads.

Axiom 1: Some roads should be fast

The aim of transport is connecting people with destinations. They can connect with more destinations if they can do so in less time. *Ceteris paribus*, faster roads will take less time. Without loss of generality, let's call these roads 'highways.'

Axiom 2: Some roads should be slow

Some roads serve neighborhoods and have traffic that is not just motor vehicles. *Ceteris paribus*, slower roads are more likely to ensure safety, both reducing the probability of a collision through higher reaction times and reducing the impact of a collision should one occur, a high quality of life, and increased interaction within the neighborhood. While people prefer to travel on fast roads they prefer to live on slow roads.[1]

[1] (Appleyard and Lintell, 1972).

Axiom 3: Fast roads (highways) attract traffic from slow roads (streets)

In general, people prefer to spend less time traveling, and will spend less time on faster roads. These roads will attract more people. There will be net reductions in traffic on streets that are made slower and net increases in traffic on roads that are made faster.

Axiom 4: Urban design, congestion, safety, and funding problems arise when different types of roads, streets, and highways are confused.

People, who are soft and move slowly, do not mix with vehicles, which are hard, when they move fast. If people feel unsafe they will avoid the place. Streets functioning as highways and managed by higher levels of government will be redesigned to be highways, – what Charles Marohn of Strong Towns calls 'stroads' – destroying their street function.

Further trying to move highway levels of through traffic on roads

initially designed as streets with lots of property access and at-grade intersections is a natural misfit that will result in local congestion.

The system is self-limiting though. Traffic and demand comprise a negative feedback system, more traffic slows speeds –> slower speed lowers demand –> less demand reduces traffic.

Axiom 5: Without strict controls, properties will try to gain direct access to highways.

Many streets started out as highways in previous generations with earlier technologies. They were once crossroads that attracted businesses and became a place. Shops prefer roads which have lots of traffic, trying to induce passers-by to stop. This is the dual or mirror of the 'Stroads' problem, in analogy, we might call them 'Reets.'

While this origin story is not of itself a problem, the road should be designed for what it does, and what we want it to do, not what it once did. Highways with traffic are attractive places to open businesses. The US Highway System (the US national system before the Interstate, which still exists) was plagued with this problem, once freeflowing roads were subject to steady speed deterioration as new motels, gas stations, restaurants, and fruit stands erupted to exploit the traffic. By design to overcome this problem, the Interstate was regulated in regard to property access, and was instead a limited access facility.

Axiom 6: Successful streets will attract more traffic.

Streets that have lots of local activity will encourage vehicle traffic as people seek to take advantage of the activity, and park their vehicle nearby. This does not justify 'upgrading' the street through widening, which takes out the very elements that made it successful in the first place.

Axiom 7: The Hierarchy of Roads is an emergent process.

Even in the absence of central planning, a hierarchy of roads would emerge.[2]

[2] (Yerra and Levinson, 2005; Levinson and Yerra, 2006).

Differentiating roads by speed (and thus flow) is a core design principle in transportation planning. The belief is that this not only better satisfies preferences, it is cost-effective. There are economies of scale associated with building a few fast roads and more slow roads, rather than all roads to equal design. From an investment perspective, it allows concentrating resources. From a traffic perspective, it isolates a few roads for fewer access points than others. From a highway design perspective, it sets aside a few roads

to be straighter and flatter and faster.

Today the hierarchy is more complex than narrow streets vs. wide avenues; it ranges from Express high-occupancy vehicle (HOV) and toll lanes at the top, to freeways, limited access highways, principal arterials, minor arterials, collector and distributor streets, to local roads.

NEW AUTOMATED VEHICLES CAN BE BETTER REGULATED THAN MERE HUMANS. There will also be a new Cambrian explosion of vehicle forms which are specialized for markets, especially in urban areas where mobility-as-a-service is plausible. This is a huge infrastructure opportunity. We should redesign our road hierarchy with these axioms and the possibility of slow vehicles becoming mainstream. We should think about developing an interconnected slow vehicle network so that small neighborhood vehicles (imagine souped up golf carts) can travel not only within neighborhoods or on campuses, but between adjacent neighborhoods, without attracting longer distance traffic, where slow and fast vehicles need not mix.

There should be interesting designs for this, which are not today's standard recipes, since this is as much at the level of network design rather than road design.

7
Garden Streets

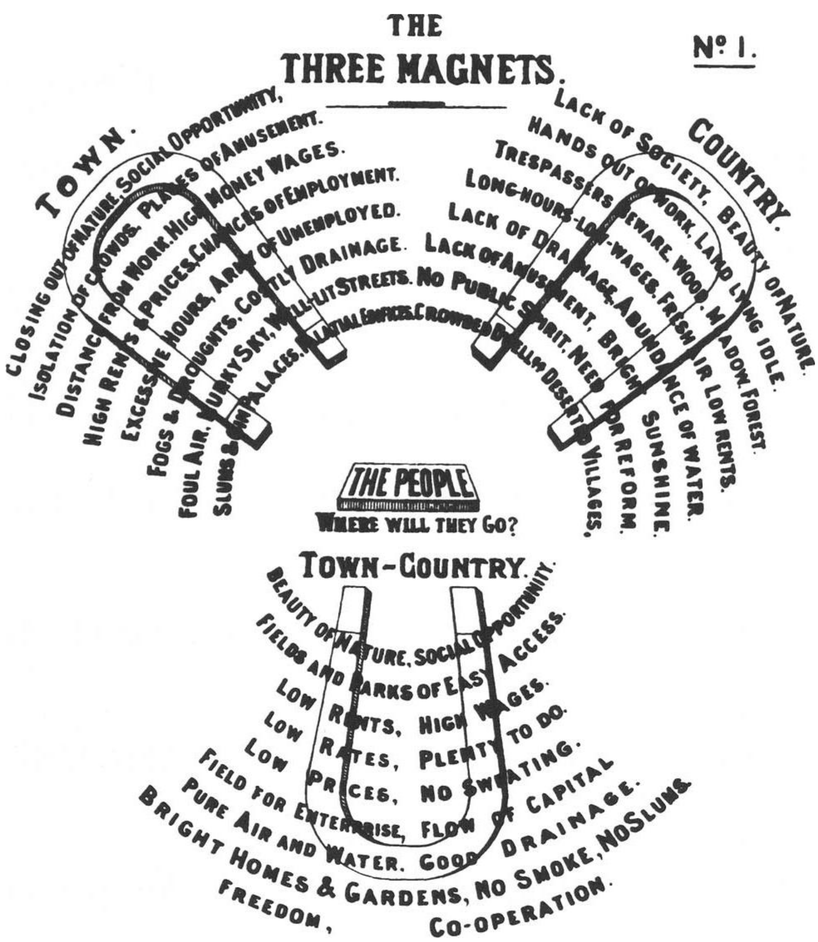


Figure 7.1: The Three Magnets by Ebenezer Howard. (Howard, 1898).

Streets should be desirable to be on.

Originally published as Levinson, David (2016-07-01) Garden Streets.

One of the most influential planning ideas to emerge from the late 19th century was that of the Garden City (Figure 7.1). Ebenezer

Howard, in his book *Garden Cities of To-Morrow* proposed constructing these new towns in the outer orbit of metropolitan London. (Howard, 1898) The aim was to fuse the best of the city and the country. Several were realized, including Letchworth and Welwyn Garden City, (Figures 7.2 and 7.3) which I had the opportunity to visit in 2006/07. The idea became a foundation for many subsequent new town plans in the UK and influences places in the US like Columbia, Maryland (Chapter 3). It today can be seen in a way as a antecedent to the New Urbanist movement. Places like Kentlands (Figure 7.4) in Maryland are not complete Garden Cities but share many elements.

Figure 7.2: Letchworth, England.

Figure 7.3: Welwyn, England.

Figure 7.4: Kentlands, Maryland. A new urbanist model. The sidewalks are nice, but distances are still long.

The idea was carried forward into Garden Suburbs, smaller units that were not as economically independent. London's Hampstead Garden Suburb (Figure 7.5) is the original example of this development. It is lovely and very expensive.

The phrase 'Garden Streets' occurred to me at some point. What would this mean? In one sense, we can think of complete streets, that function for all users, not just motor vehicles. These typically have various lanes, for pedestrians, for trees, for drainage, for bicycles, for buses, for cars. Alternatively a Garden Street might be a shared street, one where the modes were not channelized, but floated freely amongst each other. But neither of those in themselves really get at the core idea.

The phrase also brings out the idea of formal or naturalistic landscaping, as one envisions from a boulevard in a neighborhood designed by Frederick Law Olmsted. In London, the term refers to streets where any unpaved (and some paved) areas are intensively, and spontaneously, landscaped by neighbors, dubbed 'guerrilla gardeners.' This meaning is closer, but too literal.

Instead, if we bring out the original sense of Garden Cities, we want to fuse the best aspects of town and country. The best country roads, with their naturalistic landscaping are places we want to drive, ride, or walk. The best city streets with their more intensive use, still create interest if we see places we enjoy walking past because they look, sound, and smell interesting. A Garden Street fuses the best of both creating a street that is desirable to be on, because there is something interesting to see, either nature or an intense and interesting urban environment. Directed planning to create Garden Streets will induced more spontaneous action than undesigned, undesirable streets. Just as markets cannot emerge without a legal framework, spontaneous action over space and time cannot emerge without physical networks. Better legal frameworks allow more efficient markets. Better networks induce more activity.

THE GARDEN STREET ASPIRES TO THE APHORISM THAT THE 'JOURNEY IS THE REWARD.' It does not merely adjoin nondescript blacktop for storing cars, or chain linked fences, or anything that lacks beauty. The Garden Street is not traversed simply to get from here to there, but because it is a preferred place to be, the Garden Street invites you and encourages you to travel on it. It successfully competes with the screen in front of you as place to be.

Planners in the City of Hopkins, Minnesota (a second-ring suburb to the west of Minneapolis, once called the Village of West Minneapolis) who are hoping for a light rail station, have coined the tawdry phrase 'pedestrian seductive.' (see Figure 7.10) Some examples of truly pedestrian seductive places are shown. They are not perfect illustrations (Nara could be lusher (Figure 7.9), but they are places one wants to be walking in, streets one wants be on, rather than just pass through.

Figure 7.5: Hampstead Garden Suburb, London, England.

Figure 7.6: Glebe, Sydney, New South Wales, Australia.

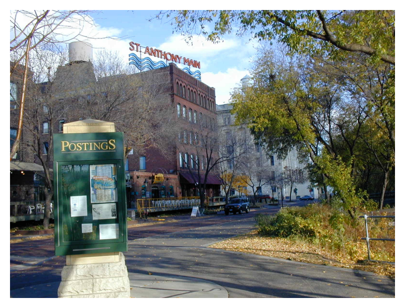


Figure 7.7: St. Anthony Main, Minneapolis, Minnesota

Figure 7.8: Woonerf in Delft, Netherlands

(a) The Mall in Columbia, Maryland (b) Nara, Japan (c) Chatswood, New South Wales

Figure 7.9: Shopping streets.

Figure 7.10: "Planners envision Eighth Avenue as a 'pedestrian seductive' corridor that will entice riders into the downtown from the light rail station planned for Excelsior Boulevard." (Warden, 2011, 2012).

8
Vitality

Figure 8.1: Street in Seoul, South Korea. Photo by author.

Originally published as Levinson, D. (2013-03-11) Five Rules for Vital Streets

'Americans are too impatient. They expect instant beauty. But they forget that cities are not built in one day. We may spend years agonizing over a renewal project and then we expect the city to be rebuilt instantly. Can you imagine what Paris must have looked like when Baron Haussmann finished with it? The social and cultural shock must have been tremendous. It's like surgery; it takes a long time for the tissue around a wound to heal. The city has to echo life. If our life is rough and tumble, so is the city. I've always felt that ugliness with vitality is tolerable. The great danger our cities face today is that their vitality will be sapped by too much concern for instant beauty. New York is not a beautiful city. It may even be ugly, but it is exciting. It draws beauty from its vitality. If you drove all the residents out and made it a gleaming commercial center, it would

only be beautiful in a narrow sense. It would be lifeless, and therefore intolerable.' – I.M. Pei

PEOPLE SEEK DIVERSE CITIES WITH VITAL STREETS.

Jane Jacobs, in *Death and Life of Great American Cities* described successful cities as having diversity satisfying four conditions, shown as Column 2 in Figure 8.2.

Vitality is the feeling that things are alive, and more subjectively something unexpected (but not too scary) might happen. Streets are vital when there is the feeling that there is something going on, of being where the action is, of people engaging in spontaneous action. Successful places have vitality. By definition, dead places don't. We don't want too much vitality everywhere (I don't want it on my street after 9 pm) and probably can't support it. But we could have more active places than we do now with a better, more focused, and less scattered location of activities. Is planning, in practice, resulting in activities being more or less scattered than they otherwise would be?

We drive to places we can walk around, rather than walk around our own neighborhood, unless we happen to live in a place with vitality.

Why do we want to walk around? We seek stimulation. Vital places have multiple things to do: find food, browse books, hear music, entice the intellect, watch people, stimulate the senses. This concentration of activities only happens because of the crowds around, and the crowds only gather because of the concentration. More begets more.[1]

[1] (Huang and Levinson, 2011).

These are 'economies of agglomeration' as the economists might say or perhaps 'network effects'. But they allow for the spontaneous walk-in business rather than the planned trip.

Many businesses are unlikely to attract spontaneous walk-ins. Consider, for instance, vacuum cleaner repairs. I don't normally walk around with a vacuum cleaner on the hope I will find a repair shop. These pre-planned destinations lose little by being located far from the center of action and save much on rent. There are limits to the value of agglomeration.

Some restaurants are so good, they require a reservation, and thus there is little spill-in traffic. But other businesses, by saving on rent, are foregoing additional foot traffic. Moreover, those businesses are denying potential spillover traffic to their would-be neighbors. It is a calculation that proprietors must do for themselves, but there is a coordination function that a good entrepreneur can serve, matching businesses that attract walk-ins with compatible stores. Shopping centers recognize this, subsidizing (lowering the rent for) those that

generate more spill-over traffic than they attract.

People concentrate for a variety of reasons – to exploit the material resources of the earth, to have safety in numbers, to find a pool of potential mates, or simply because it is at the intersections of routes between two other places. These intersections (nodes in transport lingo), create opportunities.

In the streetcar era, people might change lines at a node, where two lines crossed, and those pedestrians would contribute to the street life necessary to support new businesses, creating a positive spillover for pedestrians and neighbors (which would be capitalized in the value of land). In the highway era the scale changed, and nodes are the interchanges of freeways. Businesses, and especially shopping malls, take advantage of these points of high accessibility. But the shopping mall is now clearly the destination, not a side-product of a transfer point the way streetcar corners were.

	Jacobs: Conditions of City Diversity	Spontaneous City: Conditions for Street Vitality
A concentration of stuff (suppliers, who need not be selling)	*Multiple uses, encouraging pedestrian traffic that persistently uses streets for a variety of reasons, and for as many hours of the day as possible;* *Mixture of building ages, so that differing rents can be charged, allowing for tenants from a broader economic spectrum;*	**Buildings contiguously front the sidewalk.** Vibrant areas have buildings that abut sidewalks without large gaps between the building and the walk. The density of activity is necessarily reduced by space between building and path (and thus other buildings). (See *Filling in*) **Opportunities to explore just around the corner** Hidden (pleasant) surprises are one of the things that make cities interesting. If I go around this corner what will I discover? The same opportunities do not exist in an enclosed shopping mall, where everything is pre-mapped and tightly controlled, and I know each 'block' ends at a parking ramp. Hidden unpleasant surprises however are one of the things that can kill a city, I don't want to experience dread when I walk down an alley attached to my favorite shopping street. Information should be readily available (See *Interfaces of Freedom*)
A concentration of people (customers, though they need not be spending money, that helps)	*Sufficient density of people, both residents and nonresidents, using the streets for a multitude of reasons; and*	**Vehicle space on the street is minimal.** Wide streets increase the distance pedestrians must walk to reach other activities. Narrow streets give access to more stuff in less time. Hence the reason many enclosed shopping malls work better than many shopping streets is their compactness. (See *Shared Space*)
An environment that encourages people to spend time doing stuff (marketplace and network)	*Short blocks to find different paths, allowing exploration en route to any given destination.*	**Environment**. People prefer a climate that is dry, not too hot, not too cold, with clean air, not too loud. They also like one that is beautiful (see *Garden Streets, Winter is Coming*) **Safety**. Fast streets make pedestrians feel unsafe, and thus reduce the benefits of being on the sidewalk. Ideally streets are moving at pedestrian speed in the pedestrian area. (and if they aren't they should be buffered). People don't want a car careening out of control disturbing their sidewalk café meal, they don't want to think they will get run over crossing the street. Of course streets leading to the pedestrian area move faster, or people could not get there. One-way streets may not be inherently problematic, but one-way streets are generally that way to move more vehicle traffic faster through the area, which is the opposite goal of moving pedestrians between buildings within the area. On the other hand, one-way streets are easier to cross. (See *Shared Space*) **Convenience.** People prefer the path of least resistance. People don't want to walk too far to get where they are going. If they are driving, they want easy convenient parking near their destination, which conflicts with the condition requiring concentrations of people and stuff. They like to cross the street mid-block and don't want to have to walk to intersections. People don't want to pay for that easy convenient parking, which conflicts with basic market economics. They prefer lower to higher prices for the same good. (See *The pint-of-milk test*)

Figure 8.2: Conditions of diversity. Source: (Jacobs, 1961) conditions as cited in (Mohareb et al., 2015).

9
An Archipelago of Walkability

Figure 9.1: Famous Dave's at Calhoun Square in the Heart of Uptown, Minneapolis. Photo by author.

Originally published as Levinson, David (2012-12-17) In praise of contiguity.

Walkable areas should be well-connected.

In February of 1999 I visited Minneapolis with my then fiancé to decide whether to take a job at the University of Minnesota. It was Valentine's Day, and unseasonably warm (high 40s F (~ 9 C)), and there was snowmelt and piles on the ground, but the streets and sidewalks were not covered. We asked the concierge at the then Radisson Metrodome hotel in this early Internet era what was the most interesting neighborhood in Minneapolis for shopping and walking around. He said Uptown. (as shown in the southwest corner of Figure 9.2) They had a van that takes people to places around town, and you could call for pickup when you were ready,

though this was before mobile phones were common.

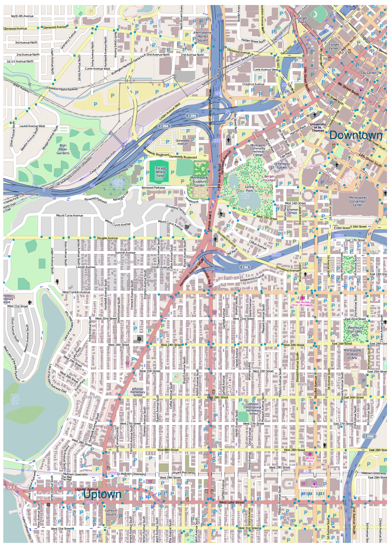


Figure 9.2: Land use pattern between Downtown and Uptown Minneapolis. Map via OpenStreetMap.

So they dropped us off somewhere around Hennepin Avenue and Lake Street, and we walked around. We went to Magers and Quinn, the biggest independent used bookstore in this part of town, and Kitchen Window. Uptown is a nice dense shopping district bisected by roads carrying too many cars. We then proceeded to walk up Hennepin towards Downtown (in the northeast corner of Figure 9.2. I could see downtown and the Basilica of St. Mary, but could not see how to get there. We migrated to the west side of Hennepin, which I knew was a major street, and figured there must be some way across. We eventually came to the Walker Art Gallery, confronting the mess at the intersection of Hennepin and Lyndale. It seemed we could not proceed. After about 15 minutes of wandering about, we found a place to cross, a pedestrian overpass at what I came to realize was the Sculpture Garden. We walked through Loring Park and eventually made it to downtown. We proceeded to walk up Nicollet Avenue through downtown.

We found our way to the Hennepin Avenue bridge, and walked into the what is now the East Hennepin neighborhood. In 1999 it wasn't much. Surdyk's cheese shop, Kramarczyk's meat shop, a brutalist Norwest (Wells Fargo) bank branch, and a broken down furniture store. You could sense it was gentrifiable, (in the positive sense of the now vilified word 'gentrification') but it was not gentrified, instead filled with vacant storefronts and buildings. There were no gentry to be found.

We hit University Avenue, which I knew would take me to the University of Minnesota where the hotel was, and we followed that for a bit over a mile, running into Dinkytown, a small shopping district just north of the University. Dinkytown also was pretty depressed at the time, the bridges over the trenches having recently been replaced, which I am told killed some businesses there. It was nothing like the neighborhoods near where we then lived in Berkeley. We then made our way back to the hotel. My then fiancé compared Minneapolis to her hometown of Fresno (which she escaped). That really bit.

After seeing other places throughout the world, notably Toronto, London, Manhattan, any continental European city, even Washington DC, I believe the problem with making Minneapolis a first rate pedestrian city is the lack of contiguity. There are some really good walkable sections, but they form an archipelago, and are not connected well (or at all).

While Uptown and Downtown are locally very walkable, one cannot easily or pleasantly travel between them on foot. In this case,

the Lyndale/Hennepin/I-94 junction presents both a physical and a psychological barrier to walking trips due to the discontinuity of pedestrian infrastructure and the low quality of the environment for non-motorized travel. Even without that, however, once developed, now undeveloped surface parking lots create an unpleasant contiguous path on the south end of Downtown.

The distribution of activity is as important as the amount in determining walkability. Barriers are readily apparent when encountered by pedestrians. But because they are difficult to identify systematically and because no standards exist for evaluating their impacts, planning for pedestrian infrastructure is often difficult to justify in comparison to auto infrastructure, for which exists nearly a century of technical methodology and guidance.

Based on casual empiricism (anecdotal evidence), it seems that many US cities could be described as comprising islands of walk accessibility. While there are pleasant neighborhoods and districts to walk in, there are significant gaps comprising unpleasant places that discourage walking between them.

Clearly connectivity is an important aspect of walk accessibility, but adjacent activity is also important, not just for generating demand, but for creating visual interest for those walking past. For instance, we might hypothesize that, all else equal, walkers prefer walking past something interesting than something barren, and thus, all else equal, interesting places will generate more pedestrians. This is discussed in a later chapter.

Specific definitions of *walkability* vary. There is general agreement, however, that walkability is fundamentally determined by two factors: the availability and quality of pedestrian infrastructure, and the qualities of the environment in which that infrastructure is embedded. It is intuitive that in isolation, neither of these factors is sufficient to create a fully walkable environment.

There are multiple causes of unwalkability in Minneapolis. I don't think one is the lack of activity. There are enough jobs in downtown Minneapolis, and now residents, that all the streets should be walkable. However, they are concentrated in a few blocks of very tall buildings rather than more blocks of shorter buildings. One of the reasons Washington, DC is more walkable than Minneapolis is the height limit. This creates more blocks with critical mass, and comparatively few blocks of surface parking. Of course if there were sufficient demand for block after block of 50 story buildings (Manhattan), a 10-story height limit would not have the same kind of effect.

Characteristics of walkability

- It is in front of well-maintained residential with trees, or
- It is in front of street-fronting retail, or
- It is along a well-maintained park, and
- There is a pedestrian walking path/sidewalk or otherwise pedestrian-dominant transportation corridor.

Characteristics of unwalkability

- It is on or crosses a freeway, or
- It fronts surface parking, or
- It fronts built walls (sides of buildings, stadia, parking ramps, etc.), or
- There is no pedestrian-dominant path.

Other walkability factors include:

- Type of infrastructure (sidewalk, unpaved sidewalk, paved trail, unpaved trail, etc.),
- Condition of infrastructure,
- Width, traffic volume, and speed of adjacent street, if any,
- On-street and off-street parking,
- Crash rates,
- Roadway intersection geometry and signage,
- Presence and type of traffic buffering (boulevard, parking lane, bike lane, etc.),
- Tree canopy coverage,
- Adjacency to water features,
- Characteristics and condition of adjacent landscaping,
- Qualities of and distance to adjacent building facade (setback),
- Type and variety of adjacent land uses (walk accessibility to destinations).

Another cause of unwalkability is the success of freeway construction – a clear violation of the *principle* that transport should serve not destroy – which disrupted the grid and changed pedestrian oriented land uses to motorist-serving. Air rights over the freeways, freeway caps, could help fix that, but the only significant air rights in the Twin Cities are Target Field (the Minnesota Twins baseball stadium) and the ABC parking ramps. Even so, the convergence of Hennepin and Lyndale Avenues was always going to be mess, and more creative designs are required.

The city is much more grid-like than dendritic, which creates opportunities, but this needs to be systematically addressed. There is of course a Pedestrian Master Plan, but the problem is not simply the sidewalks (though those should be better), it is the land use abutting the sidewalks.

Just as we are concerned about wildlife corridors for animal migration, and greenways for bikes, and continuous limited access freeways for cars, we should ensure there long, well-marked, well-maintained contiguous walkable sections for pedestrians. This would likely emerge spontaneously from a natural urban growth pattern, but has not after artificial disruptions associated with urban renewal and freeways.

10
Filling-in

Figure 10.1: Arby's at Huron and Washington, Avenues, Southeast Minneapolis, Minnesota. It was replaced by a multi-story apartment building with ground floor retail. Photo by Author.

Riding the 16 bus back from the 2014 streets.mn Writers Conclave, one could see that the construction of the now open Green Line (nee Central Corridor) (Figure 10.4) left a path of destruction in its wake. From downtown Minneapolis to past the edge of the University of Minnesota, parking ramps, the Star Tribune headquarters, the Metrodome, and WaHu (Figure 10.6) are just some of the largest redevelopment sites oriented toward this line as Minneapolis strives to become Manhattan (or perhaps we should say Maxiopolis).

Originally published as Levinson, David (2014-05-05) Seven types of urban redevelopment sites and Levinson, David (2014-09-23) The Mill District should be loopier, on the creation of new old neighborhoods.

Before we are too quick to credit transit investment as the cause of the development, note that even off the line, in places like Uptown, the Wedge, and Dinkytown, the 2010s say out with the old and in

with the new.

Yet regardless of the causes of redevelopment, it is here, it is generating controversy, and that controversy in part is a result of insufficient policy tools.

Figure 10.2: Replacement for Marshall High School, Minneapolis.

Prioritize redevelopment based on how it maintains or enhances walk accessibility.

I propose these guidelines for seven types of urban redevelopment sites:

Hierarchy of Redevelopment (with examples)

1. If it's a vacant lot – Build on it.

2. If it's a parking lot – Build on it.

3. If it's a parking ramp – Tear it down and build on it.

4. If it's an urban-hostile building (e.g. fast food restaurant with surface parking and a drive-thru, as shown in the picture at the beginning of this chapter) – Tear it down and build on it. [until we get to the last one, which we should preserve as a museum].

Figure 10.3: 4th and Nicollet Parking Ramp being demolished.

5. If it's a really, truly about to fall down building, either structurally deficient and not cost-effectively remediable or functionally obsolete and not cost-effectively adaptable – and thus abandoned – Tear it down and build on it.

6. If it's an ugly but structurally sound building (i.e. occupied or occupiable) with little or no historic or architectural importance – Wait until all of the above sites have been completely used up, see if you can do adaptive reuse and improve its attractiveness, then consider tearing it down and building something new on it.

Figure 10.4: Minneapolis Green Line - Axis of Redevelopment.

7. If it's actually a viable (i.e. occupied or occupiable), attractive or historic, functional building – Wait until all of the above sites have been completely used up, see if you can do adaptive reuse, before even considering tearing it down.

The examples are far from a complete list, and certainly there will be debate about what constitutes 5, 6, or 7, and lots of nuance and qualitative decisions.

Nevertheless, I think we are far too quick on type 6 and especially type 7 sites when there are so many sites still remaining in categories 1-5 in much if not most of the city. Developers in many locations choose to preserve parking not for market reasons, but

regulatory ones, like minimum parking requirements in excess of market demand.

The hierarchy presented above is not simply my personal preference (although it is my personal preference). It is a hierarchy that will lead to better urbanism.

A key lesson is that it is often easier to grow an urban neighborhood from an existing lattice of structures than try to plop one down on a brownfield site. ... Thus we should try not to destroy viable structures or neighborhoods until we have considered renovating them and we have exhausted vacant parcels. Of course, one might say, that is the obvious lesson from urban renewal some 50 years ago.

Figure 10.5: The former site of Wesbrook Hall, University of Minnesota campus.

Figure 10.6: Former site of Arby's Restaurant, replaced by WaHu development (rendering).

Consider a simple two-block walking route. One block (X) is a functional, occupied one-story building (with doors and windows) and one block (Y) is a zero-story parking lot. To go from A to B one passes the building (which might be interesting), and a parking lot (which probably is not). Now a developer comes in and wants to build a non-awful six-story wood frame apartment building. Where would you rather have him build this. The answer is block Y because you will then walk past two buildings, instead of one building and a parking lot. This improves walkability, which is a good value to have, since it likely increases walking, personal connections with the city, and even retail sales; but it also improves accessibility (the number of places which can be reached in a given unit of time), which produces positive economic spillovers in the interim. A six story building plus a one story building is better than a six story building and a parking lot. It's also better than a seven story or eight story building and a parking lot.

In the end, both blocks may have apartment buildings, that is fine. But you want to develop the empty lot first because 'in the end' is not 'right away.' As the recession of 2008-09 showed, we are losing urbanism during the development hiatus as projects can get deferred a long time. The sequence of development matters. In the interim, the walk accessibility (local density) will be higher when the empty lots are developed before existing buildings are torn down and replaced. [1]

There are a number of solutions to improve the sequence of development. Here I suggest awarding Transferable Development Rights (TDR) on existing sites which we want to preserve but are built less intensely than code allows, which can be transferred to vacant lots to allow those parcels to be developed more intensely.

TDR compensates the sellers for not developing right-away and

[1] For the math-inclined, if we integrate accessibility over time, it will be larger if we defer tearing down #6s and especially #7s until after filling all the vacant or vacuous #1-5 sites.

inducing the buyers with a density bonus. These would be temporary rights, so if sold, the selling parcel would not be able to be redeveloped more intensively than its current structure for a period of time (e.g. 10 years) without either buying rights from other properties, or waiting until the expiration. Of course the buyer would get to build somewhat more intensively than current zoning allows as a permanent structure. That is, even after the rights expire for the seller, the buyer does not need to unbuild their building.[2]

So imagine our scenario above. Instead of redeveloping right-away, the owner of Parcel X sells to the owner of Parcel Y a TDR that defers development on Parcel X for 5 years and gives Parcel Y one extra story. Parcel X gets enough revenue to put off development. Parcel Y may now be slightly more financially feasible with the density bonus. The community gets more walkability in the interim five years.[3]

[2] Transferable Development Rights (TDRs) preserve agricultural uses in places where it might otherwise be developed into a subdivision as a matter of right. These are also used for air rights developments. (Johnston and Madison, 1997; Machemer and Kaplowitz, 2002).

[3] If you don't like density, there is a prospective downside. TDR donating / receiving areas can be downzoned as part of the package to ensure the end state is no denser than it otherwise would be (so the as-right development would only be 5 stories, with the 6th story coming from the TDR).

11
Leapin' Frogs

Figure 11.1: Main Street - Arbor Lakes, Maple Grove, Minnesota. Photo via wikipedia

Originally published as Levinson, David (2012-06-04) Arbor Lakes - A Pedestrian Explores the Suburbs. A version of part of this chapter appears in (Levinson, 2016)

On a date night with my wife, we visited Arbor Lakes in Maple Grove (Figure 11.3). Maple Grove is a suburban area northeast of the interchange of I-94/I-694 and I-494. The areas abutting the freeway are devoted to retail. Beyond that is housing. Much of the area used to be quarry, some of it still is.[1]

Much of the shopping district is auto-oriented, a large share of this territory is parking lots and big boxes. There are however three pedestrian-friendly regions of this shopping complex. (Ignoring the insides of buildings, which are of course pedestrian-only zones).

The first is Main Street north of Elm Creek Boulevard and proceeding for five blocks. Main Street is abutted by 2-story buildings with shops and restaurants, and short blocks. There is some parallel parking on street, and the buildings back to more parking. Some of the side streets even connect not-so-terribly to

[1] This leaves lots of holes in the ground, which fill with water, which we call lakes, and Minnesotans like lakes, so these are considered a feature. Minnesota has 21,871 lakes 2.5 acres (1 hectare) or larger, but in typical fashion only calls itself the 'Land of 10,000 Lakes.' If Texas had this many lakes, it would call itself the 'Land of 100,000 Lakes.'

Figure 11.2: The Shoppes at Arbor Lakes, Maple Grove, Minnesota. Photo via wikipedia.

nearby big box centers (e.g. The Toys 'R' Us block) or local medium density housing. This area was built from 1997-2001.

Main Street crosses Arbor Lakes Parkway near its North End and on one side of the street is even more retail, followed by a park. The other side is a modern, but awfully situated government building. The building is set back from the Street, has one entrance (on the far side of all the pedestrian traffic), and is otherwise unwelcoming to walk-up traffic. It needs doors (Just north of the government center is a nice park area as well). I am sure there are historical reasons for the building giving its back to the street, (like lack of foresight by the designers, and post 9/11 security paranoia), but it results in an abrupt end to what could be a more lively street-face. Arbor Lakes Parkway is four lanes (flaring to five at the intersection), and is reasonably acceptable to cross on foot, though the crosswalks don't land on the median (i.e. the median dies before the crosswalk), which is odd, though surely for the convenience of drivers making faster turns.

On the southern edge of this pedestrian area, Main Street tries to cross Elm Creek Boulevard. At the intersection, Elm Creek Boulevard flares to seven lanes. At this pedestrian actuated signal, the pedestrian light turns to red just as we completed crossing. On the one hand, this is maximally efficient timing. On the other hand, if I were just a bit slower, I would be stranded in the middle of the intersection. There is a pedestrian landing at the median here, but it

is at the end of the second lane, so I don't quite yet realize that I am going to be stuck with a red light in front of me as cars trying to cross have a green light. Nervous pedestrians might be tempted to run by the almost instantaneous switch to a flashing Don't Walk (which really just means Don't Start Walking).

Main Street does cross though, and I see two restaurants on the south side of this intersection, but they are oriented to their respective parking lots, not the sidewalk. And their parking lots are giants. Which is too bad, because I can see in the walkable distance (about 500m) another place I might want to walk. There is a movie theatre anchoring the west end of a pedestrian oriented shopping street, a lifestyle center in the jargon, an outdoor mall. So we walked there, past the parked cars.

And we reached a less interesting, but still viable center going by the name of The Shoppes at Arbor Lakes (opened 2003), which is like a smaller version of any shopping mall without a roof and without a department store. It also has the Maple Grove Transit Center (a Park and Ride ramp). It has seen recent change (its east anchor, Borders Books, recently went out of business). You are not however expected to continue going forever. Unlike the grid of the city which offers continuing potential of surprise, that something might happen if I walk to the end of the block and turn the corner, the East Anchor stops the center. You can drive down part of the middle of this outdoor Mall, but a pedestrian-only block (Arbor Park) prohibits through traffic. The middle of the mall is street like, but seems nameless. I will call it Fountains Way because that is the street that aligns with it on the East. This would annoy the developer however, as that is the name of the next shopping center.

That the center stops is good, because on the other side of the building is a parking lot connected to a freeway entrance ramp via Hemlock Lane, and who wants to see that. It is bad, because on the other side of Hemlock (about 300m to the east of The Shoppes edge) is Fountains Drive, connected via Fountains Way, another shopping district, which is in fact walkable. But that section is only 2 blocks long. And behind it are large big box stores. The Fountains (c. 2007) is considered a hybrid-power center.

The Arbor Lakes Business Association identifies these three districts: Main Street, The Shoppes (by Cousins), and the Fountains, as three separate areas, and clearly we are the only people in the history of Arbor Lakes to have walked between the first two, much less the third.

The business association is correct, 'Arbor Lakes has it all'. Unfortunately, it is all scattered about.

ENSURE CONTIGUITY. There are many definitions of 'sprawl;' one common feature is the description of 'leapfrog' development.[2]

[2] (Ewing et al., 2003; Galster et al., 2001; Gillham, 2002; Sutton, 2003; Whyte, 1957)

Leapfrog patterns are a temporary phase in the process of land development, as the parcels that are leapt over are likely to be developed later as their value increases. But as a temporary phase, it may last a long time, depending on the pace of development and depending on the desire of developers (and their prospective customers) to maximize space between subdivisions.

One of the major costs associated with leapfrog development are the added costs of infrastructure provision. More infrastructure is required to connect the same number of people than in a compact arrangement. This has long been identified as a 'cost of sprawl.'

Another major disadvantage that leapfrog development poses is a reduction of the quality of the walk trip, making it undesirable and inconvenient to walk to major destinations (shops, jobs, schools). Local accessibility is naturally hindered by leapfrog development patterns which increase the space (and thus distance) between development.

The past decade has seen a resurgence in both the use and the study of alternative forms of transportation, including walking (as well as cycling, car sharing, and public transit, which have similar issues). Though walking is generally regarded as a distinct mode, it also forms an important component of trips made using other modes. This is most apparent in the case of public transit: before boarding and after alighting from a bus, streetcar, or train, every passenger is a pedestrian. It is true for driving as well. Every driver walks to or from their vehicle. For this reason, a deeper understanding of the spatial patterns of walk accessibility can also contribute to planning and research of other modes, especially public transit. Similarly, bike and car-sharing systems generally require walking trips to and from vehicle storage locations, and extended distances pose a disadvantage to bicycling compared to motorized transportation.

US suburbs have often been characterized by their relatively low walk accessibility compared to more urban environments, and US urban environments have been characterized by low walk accessibility compared to cities in other countries. Lower overall density in the suburbs implies that activities, if spread out, would have a greater distance between them. But why should activities be spread out instead of developed contiguously?

We observe discontinuity in our urban environment. It is a temporary (though perhaps long-lasting) stage of development which will be filled-in as demand for development increases (exogenously) while space remains finite. However, it also suggests that by increasing the costs of development (by charging development more for infrastructure), by increasing the value of local walk accessibility, or decreasing the preferences for space or parking, we will get a more contiguous built form from the outset.

There are several key points:

1. Pockets of development in places like Maple Grove indicate that individual developers are capable of creating pleasant small walkable places with fine grained streets. The resultant pattern indicates current rules and market preferences don't demand integrating these pockets to create larger walkable districts.

2. Contiguity is an important consideration. If everyone were driving, leapfrog development would not be a problem since there is a small fixed cost of getting in the car and a small

variable cost of driving. If you want people to walk, it is a problem, since the variable cost increases significantly with distance.

3. Pre-provisioning of infrastructure by local government enables development to occur with more or less equal probability anywhere within the town in the absence of a preference for walk accessibility over space. Were road construction the responsibility of developers, to ensure connectivity and reduce costs, developers would build in a more contiguous fashion.

4. Depending on the rate of development (until all blocks are developed), the town may remain far less walkable if walk access is not valued by the market, or required by the town, until it nears completion.

5. How to ensure walk accessibility in a decentralized piecemeal development process (so it does not take 30 years to complete) is not obvious, but is important. This is where some type of planning is important, either on the part of the master developers who control everything, or the government, or a negotiated compact between the individual property owners. Suppose the individual developers pooled their land and the profits in a joint venture, would the planning outcome have been better?

6. To help avoid discontinuous development, communities can either put the cost of infrastructure back on the developers of parcels, or attempt to regulate not only final densities but also interim sequencing or staging of development. This is particularly relevant when the city-building process is slow, and a lot of land has been devoted to potential future development. Not subsidizing infrastructure is far more efficient than subsidizing infrastructure and then regulating development

We can think of the transformation from unwalkable leapfrog style development to contiguous development as a phase shift. If leapfrog development is preferred early on, (due to preferences for space outweighing preferences for walk accessibility given cost responsibilities), development is disconnected. But as developments are added, the parcels congeal into an inter-connected urban fabric.

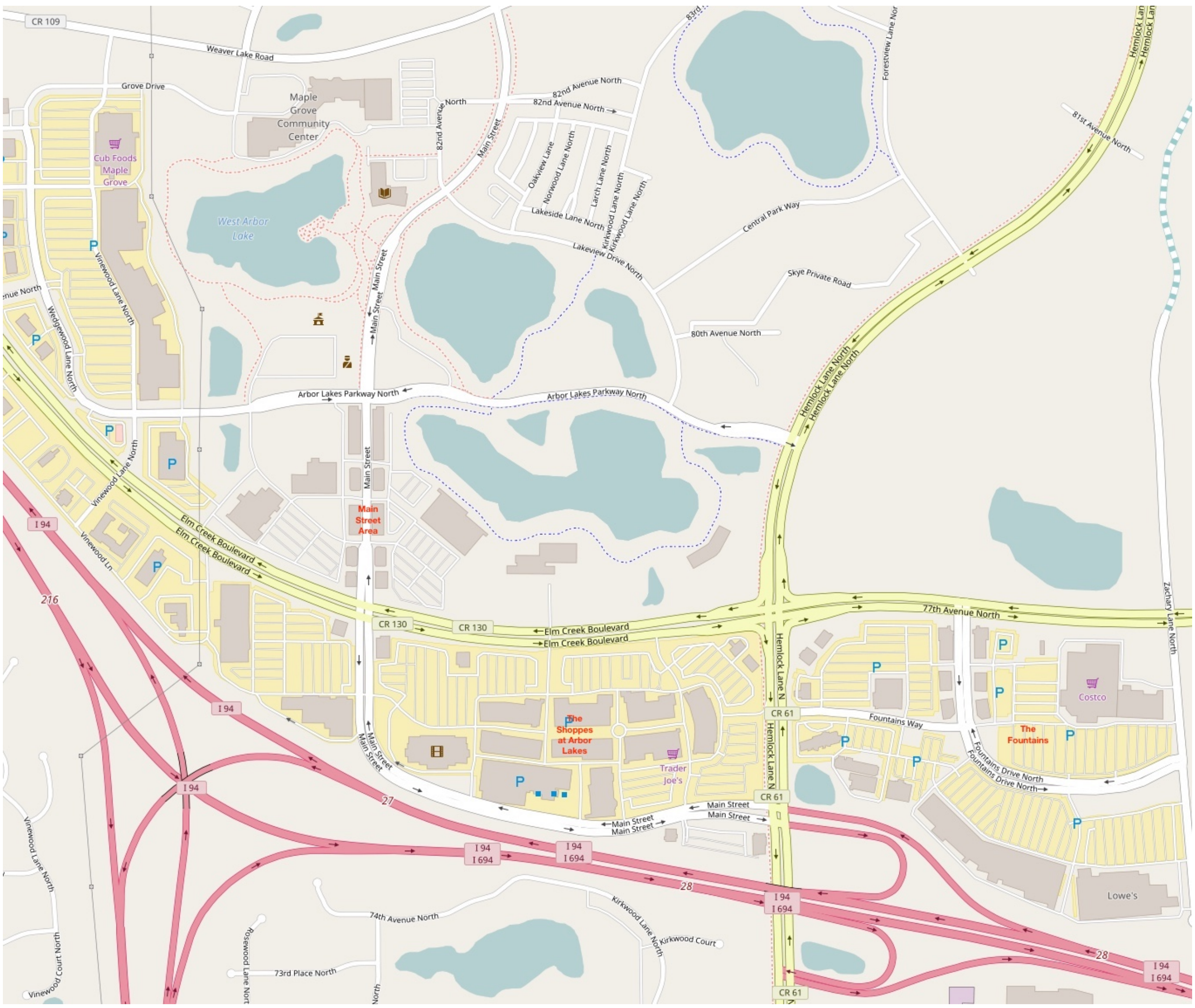


Figure 11.3: Land use pattern in Maple Grove, Minnesota area. Map via OpenStreetMap.

12
The Reorganization of Road Function

Figure 12.1: Minneapolis's Midtown Greenway runs in a former railroad trench where 29th Street would have gone. Photo by author.

Originally published as Levinson, David (2012-08-27) The reallocation of roadspace.

Today's roadspace allocation is an artifact of history but should instead reflect how we want our cities to work in the future. The urban public right-of-way (roadspace) is a scarce resource that is now publicly allocated.

Typically at the outside is a sidewalk (this might actually be on private property, but there is a right-of-passage there). Between the sidewalk and the street there is often a 'boulevard', a planted strip with occasional street trees and the frequent sign. There there is a curb and gutter. Next to this is the 'street' on which may be

on-street parking, followed by movement lanes. The on-street parking may be free or metered. In some places there are designated bike lanes, or even bus lanes. In some places the lanes are reversible in direction, in others they are one-way. There may be bus-stops. Underneath the road are public utilities (water, sewer, natural gas), above or below are cabled utilities (phone, electricity, television). There may be street-lighting. There may be wi-fi antennas on the street-lights. Some blocks are bisected by alleys, others see neighbors abut.

If there is no alley, then garbage, recycling, and reuse trucks ply the roads, and the material for pickup is placed on the boulevard. Driveways may cut into the street.

People may wait on the boulevard for buses (school buses or public transit). There may be a shelter, or a sign. The buses may stop on the right-of-way to board and alight passengers.

We need to be more creative about how we allocate this space. In the US, most cities west of the Appalachians arrange the streets in a grid. This regular, monotonous, grid has many features, but one that is often not used to its fullest is the ability to differentiate.

Presently the links on the grid are largely equivalent, except that some links are collectors and distributors, and serve residential land uses, while others are arterials and serve commercial land uses, and have transit running on them.

Let's imagine we have a significant commercial arterial every tenth east-west street (10th, 20th , 30th, and so on) (approximately every mile (1600 m)). How do we allocate the road space on the 9 blocks between them? Are they all the same, serving moving and stored cars, or can they be differentiated.

Suppose instead of assuming all modes should mix (and therefore give dominance to the private automobile on all blocks since it has greater number, speed, and mass and will win every conflict), let's take one of those streets (say the Nines: 9th, 19th, 29th, 39th, etc.) and say it is for bicycles only. People who live on the Nines would have to park their cars on another block or in the alley behind, or maybe some off-street parking can be found. This bicycle-only street would only have stops when crossing a major north-south arterial, and yield at transit routes or other specialized routes. That means on only half the blocks they would have a 50 percent chance of having a red light, and on the remaining blocks they would have unchallenged right-of-way.

These are what are called 'Class I' bikeways in the jargon, as they are exclusively for bikes.

Suppose we dedicate the Fives (5th, 15th, 25th, 35th, etc.)

exclusively to public transit and taxis. This route would be about one-half mile (800 m) from the transit-served arterials, and thus would ensure all travelers are within one-quarter mile (400 m) from a transit service (though perhaps a longer distance to a stop). The frequency here would be fairly high, and stops would be every 2.5 blocks, so the Manhattan (network) distance for the farthest passenger would be one-half mile. This route would be exclusively for transit (and taxi) movement and stops, and transit vehicles would not have to stop except at the arterials and other transit routes, where there would be stops and transfer points anyway. The Transit service would be laid out in a near perfect grid.

Suppose we dedicate the Ones (1st, 11th, 21st, ...) to truck movement. Trucks still need to move through the city, but the arterials are already congested with transit and private car traffic. Freight could use other links for access and egress to particular buildings, but use only the Ones for longer distance movements within the city. These roads would be rebuilt with much stronger pavements to withstand the greater use and abuse. Other vehicles could use the Ones, for movement but there would be no on-street parking here either.

Suppose we dedicate the Threes and Sevens to one-way (west-bound and east-bound respectively) vehicular movements. These routes would move a bit faster than the two-way links, would not have to compete with stopping vehicles as much, and would draw longer distance traffic. They would be given a green wave at a socially desirable travel speed.

We would do the same thing on north-south arterials, so that 9th Avenue (N-S) meeting 29th Street (E-W) would be a bicycle-only intersection.[1]

This scenario is designed to stimulate thought about link differentiation, not as a formal recipe. Cities should systematically and strategically reconsider roadspace allocation in order to better facilitate the movement of multiple modes in a complex environment. Tactically, such an orderly plan rarely works out as dreamt, physically barriers get in the way, and specific routes will need to be bent to fit the local landscape and built environment.

[1] Some of this is familiar to Minneapolitans: 20th is Franklin Avenue, 30th is Lake Street. The Midtown Greenway (Figure 12.1) is roughly 29th St (though of course it is better since it is an exclusive, mostly grade-separated right-of-way). 26th St and 28th St are a one-way pair. But we have not done this strategically or fully. We mix transit and private cars on arterials. Transit buses run on 26th and 28th, not on 25th. We certainly mix trucks with cars excessively.

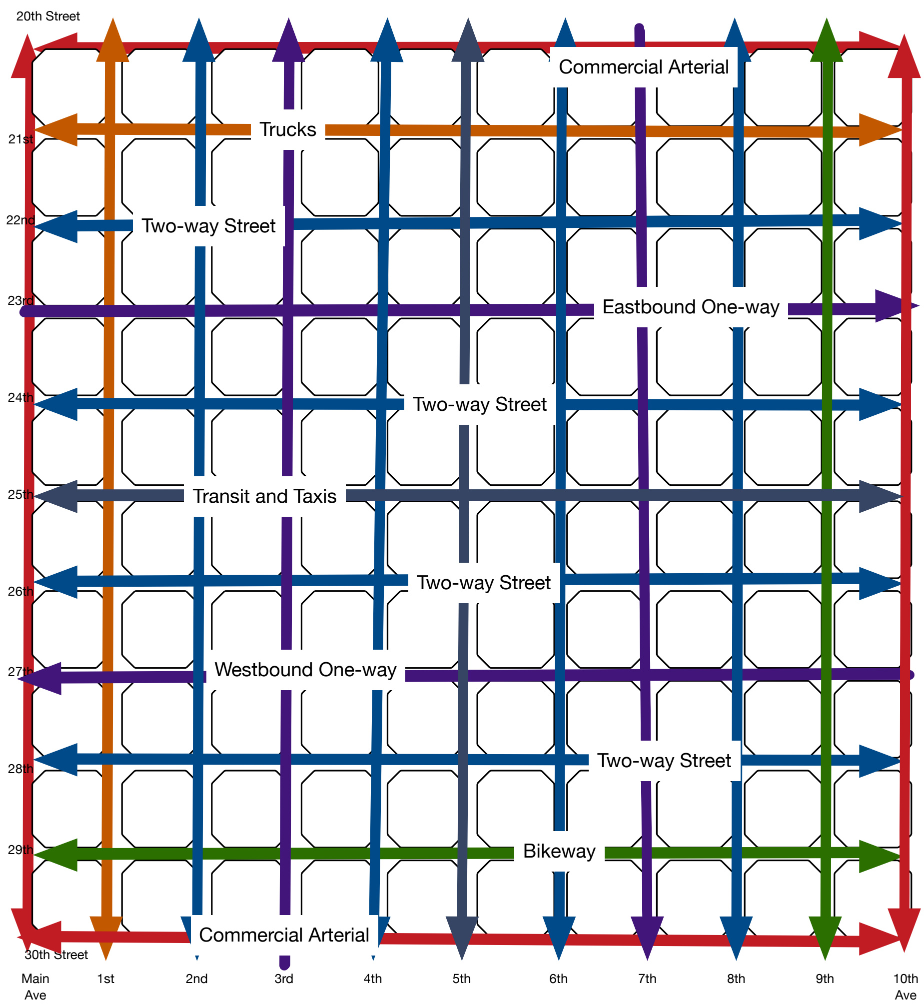


Figure 12.2: Reorganization of road function

13
Beyond the Plan View

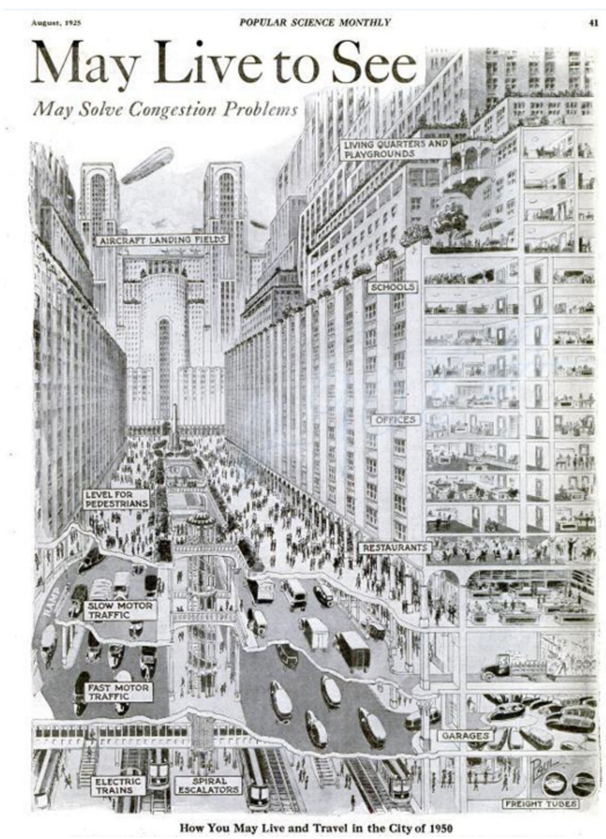


Figure 13.1: Popular Science (1925) May Live to See: How you May Live and Travel in the City of 1950. Source: Public Domain.

Designs should be multi-dimensional. Barney Frank once quipped about Boston's Big Dig, officially the Central Artery/Tunnel project, 'Wouldn't it be cheaper to raise the city than depress the artery?' Indeed it would have. Early 20th century visions of the future thought about 3-dimensions, not just of buildings, but of travel. We seemed to have lost many of those

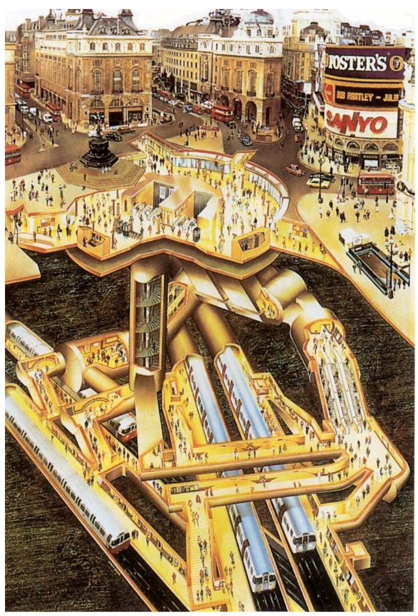
visions in present-day urbanism.

We seldom built such things as shown Figure 13.1, but we have opportunities to take advantage of 3-dimensions to benefit all travelers. First, it increases capacity per unit space. There is more density to the transport infrastructure in these 3D renderings then our current flat-land. This is only worthwhile if density is high and crowding occurs. But the denser the network vertically, the less space it requires horizontally. Second it increases pedestrian safety by eliminating pedestrian/vehicle conflicts.

A fourth dimension is time. How we use places changes over time. Sometimes it is a street for moving cars, other times the same places is a public event space. Some events are seasonal. The technology changes, so the same space may be used in different ways 10 years from now as today.

The sections in this chapter consider dimensions of transport and land use design beyond the typical two-dimensional top-down plan view which planners, by their very name, are most familiar way. Consider differing spatial perspectives and new designs emerge.

Figure 13.2: London Underground cutaway views.



(a) Cutaway - Picadilly Circus.

(b) Cutaway - Bond Street Station.

13.1 *In defense of skyways*

Originally published as Levinson, David (2012-01-09) In defense of skyways and Levinson, David (2016-02-15) On Skyways and Bridges

Today's urbanism proposes to tear down skyways and put people on the street with cars. We should think carefully about where cars and people mix, and where they don't. If cities are going to continue to have cars, ask: "why must they mix with pedestrians and bicyclists?" People slow down cars of course, and that decreases accessibility and opportunity for the motorized. Similarly, cars slow down and endanger people, also reducing the ability of pedestrians, bicyclists, and surface transit users to freely engage in spontaneous action.

Figure 13.3: Leonard DaVinci sketch

Following the model of famed shopping mall architect and pedestrianized district promoter Victor Gruen,[1] Minneapolis downtown business interests decided in the early 1960s to build skyscrapers and skyways – elevated and enclosed walkways connecting those skyscrapers – and have reinforced that decision by continuously adding to the skyway network.[2] Skyways have since become the iconic transport mode of Minneapolis, the equivalent to London's Routemaster bus or Tube, San Francisco's Cable Cars, or Venice's canals.

[1] (Gruen, 1964).

[2] (Corbett et al., 2009; Huang and Levinson, 2013).

Urbanists nevertheless oppose skyways, and this defense may be the most controversial of the book in those quarters.

Certainly, it cannot be roofs that urbanists object to. Almost all of them live in shelters with roofs. They all advocate roofs for their mass transit vehicle. So what is special about the short trip between their shelter and their vehicle, that it must remain unroofed.

Further it cannot be the lack of vehicles on skyways they object to, many urbanists like pedestrian zones so long as they are dominated by pedestrians.[3]

[3] Jeff Speck and others seem to want cars in their shopping districts though. See e.g. (Speck, 2013).

Is it their tubular nature? Maybe urbanists hate tubes (and Habitrails and gerbils)? Living in Atlanta, I have heard the skyways there referred to as 'Honky Tubes,' so there are clearly racial overtones.[4]

[4] 'Honky' was a pejorative for white people, usually spoken by non-white people, common in the 1970s, but never as offensive as the N-word.

Skyways are a bit minimalist, not the lush environment some may seek. But that is simply a design choice.

Is it the elevation? But most urbanists think something like the Vancouver SkyTrain is a good thing, and support transit with grade separation so it can go faster. Why not people? I fully understand not liking forcing pedestrians onto a pedestrian bridge as is common in China, so that walkers and cars are separated, where the pedestrian must climb and descend a staircase, but that is not the case here.

Is it the ownership? But most American cities grew rapidly under an era of private transit, so what is public vs. private space is also ambiguous. Streets are more clearly public, but if I let people pass

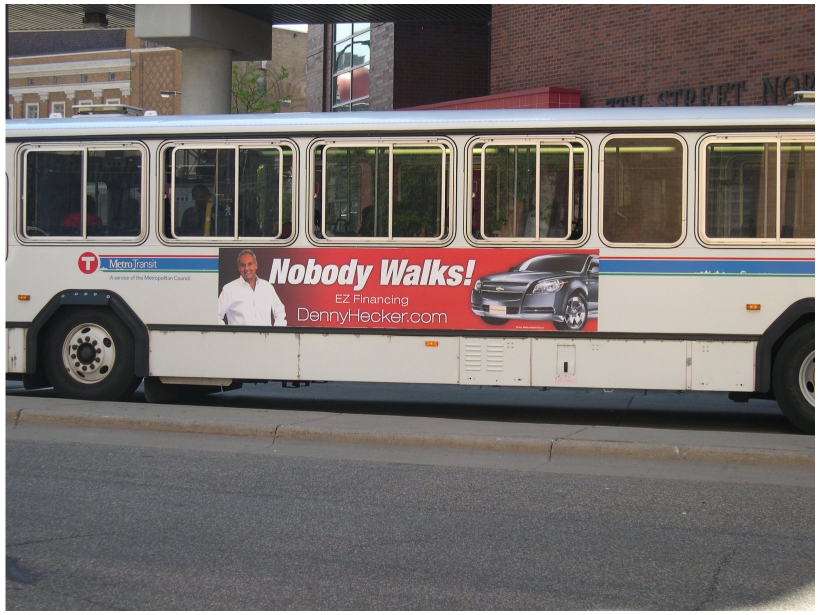


Figure 13.4: 'Nobody walks!' car ad on bus Minneapolis. In a fit of urbanist karma, car dealer Denny Hecker wound up in prison.

through my buildings, seems a good thing for the public, no? If the skyways were all publicly owned, would it be okay then?

Skyway opponents must answer why all modes should interact on all levels. Most pedestrians probably don't appreciate walking on a sidewalk next to 3 or 4 or 5 lanes of motorized traffic, why should they be confined to a narrow building hugging strip rather than travel on a strictly pedestrian level. Why should humans lower (one might say degrade) themselves by letting mechanical vehicles share their space. Why shouldn't they rise above, as Leonardo DaVinci (Figure 13.3) would have them do?

Often there is a complaint that street life moves to the skyway level. While I point out that streets steal urban activity from the skyway system, skyway opponents seem to feel the converse is more relevant. In short, streets are less vital if half the pedestrian traffic is indoors. If streets are less attractive than skyways, customers will switch, and businesses will follow. If that's what customers want, what is inherently wrong with that? The problem is not that skyways are nice, it is that streets are not. Instead of penalizing customers who prefer a skyway, entice them by improving the quality of the street.

Nevertheless, tall buildings (say 20 or more stories) should generate sufficient traffic to support retail on both the street level and the internal skyway level. Short buildings don't justify skyways, but tall buildings do.

Skyways reduce inter-building transport costs. This should increase inter-building activity and thus economies of agglomeration. Given the only purpose of cities is to connect people at low cost for some mutual advantage, the better cities connect people, the better off everyone is.

While I am not convinced building skyscrapers was economically wise, given skyscrapers and an arterial street network on which every street and avenue is an entrance or exit to a radial freeway, as is approximately true in Minneapolis, skyways are a reasonable way to connect buildings and provide a welcoming pedestrian environment.

Some argue it is the admission of defeat with regards to the street. By bridging over the street, acquiescence to the skyway recognizes the street is dedicated to motorized uses, and thus too fast, and too wide, and pedestrians will be at best unwelcome. Certainly this is true. As 'The Serenity Prayer' common in twelve-step program says:

> God, grant me the serenity
> To accept the things I cannot change
> Courage to change the things I can,
> and wisdom to know the difference.

In economic jargon, while no cars downtown might be a 'first-best' solution for pedestrians, we don't live in that world in many cities. And even if we did eliminate cars, trucks, taxis, and buses remain, and in large cities comprise a significant amount of vehicular movement. Given the world where motors dominate streets, a pedestrian-only level is a viable, and in many ways, even preferable, 'second-best' solution.[5]

So, is all lost for street life in American urban centers like Minneapolis, or can such conditions be changed? I admire the quixotic quest to rid city streets of cars. Sadly, I see no evidence that more than a few streets in America's downtowns will be pedestrianized any time soon. Skyways are the best alternative given that state of the world.

Could the skyways be better. Of course. Some ideas:

- Skyways can better connect to the street network with staircases or lifts adjacent to the sidewalks.
- Skyways can follow a more regular topology. More importantly the internal skyway level network inside the buildings themselves could be far more navigable than it is. While it is fine for regular commuters who learn the ins and outs, its medieval labyrinth is horrible for the unfamiliar traveler.

Figure 13.5: Attached housing over pedestrian path: Stevenage, England

Figure 13.6: A reconstruction of 'The London Bridge' from around 1600. Published in London's 'Southwark News'. Source: 3dartvision.

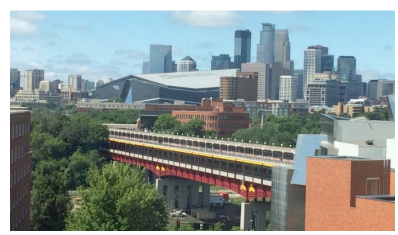


Figure 13.7: 'Washington Ave bridge as a truly multimodal infrastructure offering bus and LRT services, bike lanes, covered walking trail and an auto lane.' Photo and caption by Alireza Khani

[5] (Lipsey and Lancaster, 1956).

- The Skyway level should be on the 10th or 20th floor instead of the 2nd (The Petronas Towers at Kuala Lampur puts them at the 41st floor). This would require more coordination, but may be more useful in reducing the total amount of vertical movement required for inter-building personal transport. It is probably a bit late to retrofit existing systems like in Minneapolis, but should be considered in cities newly adopting skyways.

- Skyways should be public spaces. The record in that regard is mixed at best. They pass through private buildings, and their regulation is far from clear.

Yet despite all that, the question ‘what is a skyway?’ cannot be easily resolved with words alone. Photos from Vienna, Austria (Figure 13.8) and Stevenage, England (Figure 13.5) illustrate the problem. When does the cavity under a bridge become a tunnel?

London Bridge (Figure 13.6) is another example, the other way about. It is a skyway of sorts, a bridge over a river with buildings on either side (though not at the entrance to the bridge).

Pedestrians without the bridge would need to swim, ferry, or walk on water. The pedestrian traffic attracted business, so it went from a typical bridge for movement (a skyway over the main transport artery in London) to a mostly-enclosed bridge with shops. Is this good or bad?

The Washington Avenue Bridge (Figure 13.7) over the Mississippi River is now truly multimodal, with a lower deck for cars, buses, and LRT, and an upper deck for pedestrians and bicyclists, with a rotting, smelly, but warm enclosed section for pedestrians. Is that deck a skyway? Obviously the aesthetics are no London Bridge, but is it inherently bad, or just poorly executed?

(a) Skywalk.

(b) Connected buildings of same organization with multi-story skyways.

(c) Building over street.

(d) Pedestrian tunnel.

Figure 13.8: Skyways in Vienna, Austria.

13.2 *Vertical space - design for health*

Originally published as Levinson, David (2013-01-28) Stairing us in the face.

There are many social engineering messages to get people to take the stairs instead of the elevator. I normally do this if I can, and agree that it is probably healthier (though the energy savings is small) as claimed in Figure 13.9.

However, the state of our stairs is disrepair and disgrace. Many of our buildings were not designed for this new trend, and stairs seemed to be only intended for fire emergencies.

To wit, some pictures (Figure 13.10) of my favorite and least favorite staircases, which I regularly used at the University of Minnesota. Clearly no one has got the message that stairs should be at least as attractive as elevators, even if they are fire emergency stairs.

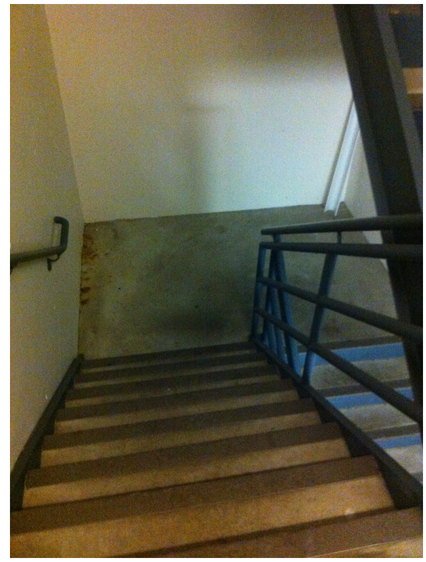
Compare this with your most recent elevator ride. In most buildings, the elevator is usually a much a nicer ride. Why?

If we want people to take the stairs, make the stairs just a little bit nicer.

Figure 13.9: 'Burn calories, not electricity. Take the Stairs! Walking up the stairs just 2 minutes a day helps prevent weight gain. It also helps the environment.' Sign originally from New York City Department of Health.

(a) Staircase 1: University of Minnesota Institute on the Environment, staircase is open and connects floors.

(b) Staircase 2: Transportation and Safety Building - Painted, and with windows, but one would hardly call it nice. It functions not just as a transport corridor for people, but also for drains, making it easy to service, like your utility room.



(c) Staircase 3: Transportation and Safety Building - From the same building, but a different staircase. Not even as attractive as the first. Without windows or natural light, not carpeted nor tiled, the walls painted with an undifferentiated institutional color.

(d) Staircase 4: Civil Engineering Building - From the Civil Engineering building, this is a side entrance, not intended by the architects as anything but for service, yet it is the fastest way in and out of that highly circuitous building from the south and it gets a lot of traffic.

(e) Staircase 5: The University of Minnesota's Civil Engineering atrium makes better uses of staircases.

(f) Staircase 6: Central staircase at Civil Engineering descends 8 stories into Dante's Inferno. It is not welcoming.

Figure 13.10: Staircases.

13.3 Air rights

Originally published as Levinson, David (2014-03-24) Making I-94 Better: Or Toward 3-D Urbanism

Figure 13.11: Met Life (was Pan Am) Building air rights at Grand Central Station in New York City.

Freeways have sliced through cities, severing neighborhoods and scarring the landscape. When these freeways are elevated, they are there for all to see. but when they are below grade, the opportunity arises to cap them, so that they become less visible, if not entirely unseen.

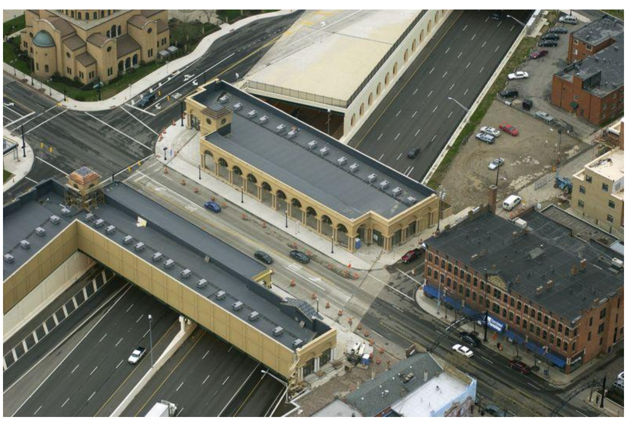
The good fortune many cities find are freeways that are already depressed (not to say depressing) for large distances. Thus bridging is relatively straight-forward from a technical perspective.

What do you put on the bridge? The opportunities are endless. Some examples of air rights projects both real and imagined are shown in Figure 13.12. But housing, shops, or any other type of activity that will fit could sit above a freeway.

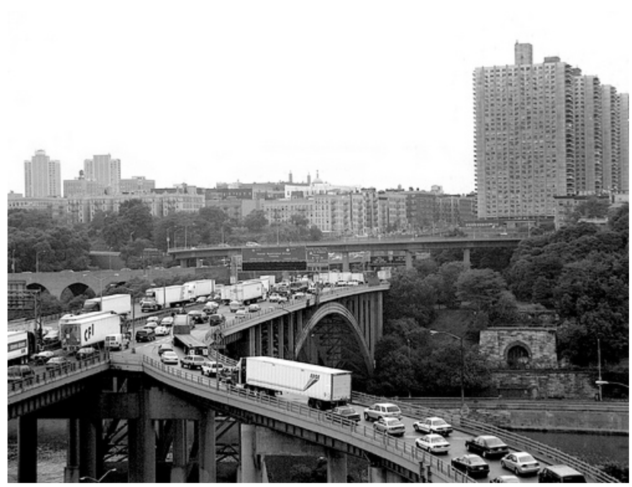
Land is not yet so scarce through most of the US that the market feels the need to go creating much new real estate over the freeway system. However, cities that do bridge over the freeway (or rails), in addition to creating more real estate to defray some of the cost, also have potential spillovers raising the value of nearby land by some amount. This increase in value could be captured to help pay for the cost of the freeway cap. How much more would someone pay to be one block from a park or a freeway cap with some street fronting retail than one block from a freeway? This is quantifiable. Whether this is sufficient benefit to pay for the costs is an empirical question. There are further benefits possible from noise reduction, better pollution control, and the like which are also quantifiable. Such an uptick in value has the potential to displace existing neighbors, especially renters, who were willing to tradeoff the negative effects of the uncapped freeway for a lower rent.

(a) Duluth's Leif Ericson Park.

(b) Seattle Freeway Park. Photo by Maciek Lulko via Flickr.



(c) Columbus Freeway Cap.



(d) George Washington Bridge Apartments. Air rights in New York City.

Figure 13.12: Air rights, freeway caps, and land bridges.

13.4 *The space beneath*

Today we live in a world with mostly planar (2-dimensional) networks, but the occasional overpass/underpass situation emerges, braking the plane. We are often at a loss with what to do with the space beneath (Figure 13.13) elevated transport facilities.

SPACE NEED NOT BE WASTED, WHEN NOT USED FOR TRANSPORT, IT CAN BE INSTEAD PUT TO OTHER CREATIVE USES.

Figure 13.13: What to do with the space beneath?

(a) Borough Market under Railway, London

(b) Shops in the Viaduct, in Brixton, London

(c) Carousel under Freeway at Darling Harbour in Sydney, Australia.

13.5 Fair space

For the 12 days before and including Labor Day, Minnesotans reconvene at the State Fair. It is traditional and embedded in the culture. It matters to Minnesotans, unlike the fairs in other states I have lived (Maryland, Georgia, California, and New South Wales, which has the Royal Easter Show). It is reportedly the best in the United States, though no doubt Iowans and Texans would contest those reports. The evidence for its centrality is that the University of Minnesota cannot open for classes until after the Fair concludes. The reasoning explains there is some shared parking, and that would involve traffic chaos, but we know it's the Pronto-Pups.

Originally published as Levinson, David (2012-08-27) All Minnesota's Affair.

Fairs enable mobile customers to meet mobile vendors. We often now think of the fair as a place for entertainment, what the British call a Fun Fair, like Carter's Steam Fair, or the Midway (or Kidway) at the Minnesota State Fair. That fun too is commerce, we exchange bills for thrills.

As Kevin Krizek and I write in *Planning for Place and Plexus*(Levinson and Krizek, 2007):

> Permanent marketplaces were supplemented with temporary and traveling fairs. The first fairs have been dated to 500 BCE, and may have occurred earlier. Fairs were events where foreign traders could show their wares, and were often coupled with religious festivals, taking place at and around temples. The fair changed over many centuries, evolving into several different types of activities, ranging from world to state and county fairs to conventions and trade shows. They are now less a place for purchasing, and more for information exchange. In fact, the International Association of Fairs and Expositions (IAFE), which specializes in agricultural events (like State Fairs), itself has an annual convention and trade show in Las Vegas.

There is the food. The fair brings foods one does not ordinarily encounter, deep-fried candy-bars on a stick, Scotch eggs, cooked sushi and poutine. Where else can you get ice cream made by a John Deere! Everyone has their go-to places, and the advantage of traveling in a large group is the increased ability to sample a variety.

At the State Fair, in addition to every organization getting publicity, there is commerce. Machinery Hill was once the go-to place for farm equipment. There is still farm-equipment, but machinery now includes cars, motorcycles, and all terrain vehicles.

The fair is an *event city*. A temporary city, in miniature, that has all the feature of a permanent full-sized place. There are residents, production, consumption, entertainment, inputs, outputs, economies of agglomeration, specialization, and so on. It comprises public streets over which the pedestrian has precedence.

WOULD THE REAL CITY WERE LIKE THE FAIR, AND CARS DOMINATED STREETS ONLY ON THE FAIRGROUNDS, ONLY DURING THE CLASSIC CAR SHOW.

(a) Entertainment, like Carter's Steam Fair, Barnes Commons, London, is an attraction that has come to dominate.

(b) Walking French Fries, traditional, healthy, organic, agricultural foodstuffs keep people coming back to the Fair

(c) A big Red Wing shoe, Minnesota State Fair, illustrating commerce

(d) Horses and animal trading are the origins of Fairs.

(e) Farm implements. Nothing runs like a Deere.

Figure 13.14: Minnesota State Fair - Event City.

13.6 *Kerb, your enthusiasm*

Originally published as Levinson, David (2015-07-13) Kerb your enthusiasm.

Walking along the sidewalks of most American cities, every block the pedestrian must undulate, going down to meet the road, walk across (a sometimes marked, sometimes unmarked) crosswalk, and then up a curb, or at best a curb-cut, to meet the level of the sidewalk again.

Why does the pedestrian need to lower themselves to the level of the road?

THE LOCAL STREET SHOULD INSTEAD RISE TO MEET THE PEDESTRIAN. This accomplishes several things.

- It slows down traffic, providing an effective speed-hump for turning and through traffic. (Increasing safety and residential interaction).
- It reminds vehicle traffic (cars, trucks, buses, and bikes) there are pedestrians about, and they are the aliens, not the other way around.
- It increases pedestrian speed, as pedestrians will obviously have the right-of-way at such street crossings, and won't fearfully cower before the motor.

This kind of design is seen in many places throughout the US. But you say 'we really have no *woonerf* [living streets] here.' Yet we do. We call them alleys. When entering an alley, the car rises to the level of the sidewalk (or nearly so). The car goes slower. The driver is more likely to be on the lookout for pedestrians.

In Rotterdam, Netherlands the sidewalks are often continuous elevation across streets (i.e. there is no cross-walk, there is a cross-drive). This helps remind drivers they are entering a *woonerf*. Drivers must slow down since they are crossing the pedestrian right-of-way, rather than vice-versa. If there is one thing I could do to American residential neighborhoods, it would be implementing the *woonerf*. If there is one thing I would build to tell drivers they are in *woonerfs*, it would be this sidewalk extension across the local street (when it joins a major road) as a way of signaling to drivers they are in a new space. This is far more effective than signs or changes in pavement surfaces alone.

Let's rethink our residential streets as residential spaces, where cars are permitted but not preferred.

(a) Alley entering view

(b) Alley exiting view.

(c) Alley side view, the sidewalk mostly holds its ground, though it tilts slightly to accommodate the alley entrance.

(d) The sidewalks of Rotterdam bow to no street.

Figure 13.15: Kerb, your Enthusiasm.

13.7 *Eyes on the Street*

EYES ON THE STREET HELP MAKE SPACES DEFENSIBLE.[6]

Jane Jacobs coined the phrase 'eyes on the street' to describe spaces that are safe because they are monitored.[7] Safety in the public is not a new problem.

In 1285, the Statute of Westminster, apparently the earliest English law concerning the subject of road maintenance required of manors:

> '... that highways leading from one market town to another shall be enlarged where as bushes, woods, or dykes be, so that there be neither dyke nor bush whereby a man may lurk to do hurt within two hundred feet of the one side and two hundred feet of the other side of the way.'[8]

This kind of clear zone logic is applied (to a lesser extent) in modern roads to ensure a different type of safety, that of the occupant of a high-speed vehicle encountering (or not) a fixed object on the side of the road.[9]

[6] (Newman, 1972).

[7] (Jacobs, 1961).

[8] (Webb and Webb, 1913).

[9] (Dumbaugh and Gattis, 2005).

(a) Police preparing for a Black Lives Matter protest (that never came) at Rosedale Mall in Roseville, Minnesota. That's one way of getting 'Eyes on the Street' (or parking lot), but not what Jane Jacobs imagined.

(b) Transit stops provide eyes on the street, at least sometimes, St. Paul, Minnesota.

(c) The sidewalk café is another source of local observation, Eveleigh, Sydney, NSW.

(d) A food and farmers market has merchants watching their environment even more carefully than the shopkeeper at Rouse Hill, New South Wales.

(e) Shops in Bellefont, Pennsylvania, on a traditional small town American Main Street.

(f) Open Streets close the road to motor vehicles for a weekend afternoon. This one is on Franklin Avenue, Minneapolis.

Figure 13.16: Eyes on the Street

14
Interfaces of Freedom

Figure 14.1: Transit information in Tokyo. Photo by author.

Everyone's a newbie sometimes. Whether entering a city for the first time, or entering it for the five-thousandth, a traveler interacts with the environment to obtain cues. A first-time traveler is very concerned about issues of navigation . . . where should I go? . . . how should I get there? The experienced resident may rely on memory and history to make those same decisions. Yet in complex cities, there are many places even the most experienced residents may never have

explored, there are paths untaken, and like Heraclitus' River, you never really step into the same city twice. Cities are by nature hard to understand. This limits the ability to use them spontaneously. The designer should attempt to reduce the difficulty. *Cities cannot be a seamless experience, they are too complicated. But they can strive toward seamlessness.*

PROVIDE SHORTCUTS FOR THE EXPERIENCED USER. Unlike the newbie, the experienced user understands more or less how the system works, at least for them. Standards provide shortcuts. Without standards, everything must be learned anew, everyone is a newbie. Standards must be consistently applied, or else they are not 'standards.'

Much has been written about the human-computer interface, and there is research about user interface, and about ergonomics. There seems far less research on the human-city interface. These musings consider the interaction between the human and transport systems.

14.1 Size perception varies with age and experience

Figure 14.2: Lexington Market in Baltimore (2008). Photo by author.

When I was in nursery school, and my mom took me for a walk around the block, it felt like forever. It was only one-thousand feet (300 m) but my perception was distorted by my short legs and my short life. An hour to a 3 year old is the same percentage of life as 10 hours to a 30 year old or a day to a 72 year old. In brief, it's not a short trip. A ten mile trip by car from home to Baltimore's Lexington Market (14.2) was 10 miles or 23 minutes, it seemed like hours. Lexington Market itself felt huge, with its dozens of stalls.

But what is true for a 3 year old is also true for an adult who is going somewhere for the first time. The trip always feels longer the first time you make it than when it is routine. The 'mental transaction costs' of a new trip, having to sight new sites, think about every turn, and so on are far more taxing than a daily commute after a month or a year.

The advantage of cities is they reduce real travel costs, they bring more things within a reasonable time, they create access. But people's perceived time and objectively measured time are two very different things. To adapt Jim Morrison:

PLACES ARE STRANGE WHEN YOU ARE YOUNGER, MARKETS LOOK LARGER, WHEN YOU ARE NEW.

14.2 *Airport wayfinding*

Originally published as Levinson, David (2006-05-09) The urban interface: some initial musings.

I am an experienced traveler. Not the most experienced, and certainly not the least. I have also lived and worked in several different metropolitan areas (Baltimore, Washington, Atlanta, San Francisco, Minneapolis) for at least five years each, and have passing familiarity with dozens of others.

Today when we travel to another city, we often do so by airplane. As a result, our first experience of a new city is that city's airport, which, for better or worse, has a similar interface regardless of where you are. When departing a plane (and not making a transfer), first you look for signs for baggage claim and ground transportation. Airport signs are most often hung from the ceiling. They use a sans-serif font, often HELVETICA, and are easily read if one reads English (as do the readers of this book). In many airports, second, third, even fourth and fifth languages may also be presented, based on the fluency of airport users, but to English-speakers, that other text is just noise to be ignored, or an quick and interesting way of learning bits of the local language (Niet Roken! is Dutch for No Smoking!).

The weary, English-reading traveler will follow the signs towards baggage claim, and walk (or stand on a moving sidewalk) covering a distance of sometimes more than 1 km, traversing an airport that was (generally) never designed to be this large, but grew and grew as demand once and again outstripped forecasts. In larger airports there are people movers or bus shuttles connecting some of the far points, often added as an afterthought, sometimes integrated into the design of a modernized or reconstructed terminal building or campus. If this is an international trip, there is a whole additional layer of immigration and customs that must be successfully navigated, with baggage claim after immigration and before customs.

Interfacing with the city includes areas that are somewhat understood, such as wayfinding, but it is much more, not simply how to find a path, but how to decide where to go, what to do, and when to do it.

We need to understand what happens once you leave the ubiquitous, ungainly airside of the airport and begin to see daylight (at least through the cracks of the double-decker roadway), and breathe fresh air (redolent of diesel). In airport terminology, this is the groundside. People who design airports are likely to have been fascinated with aviation as youth. I would venture almost no one goes into airport design to improve the groundside, the place where

the city meets the world, or in the case of arrivals, where the world meets the city.

Once our weary traveler has collected his luggage, he seeks ground transport. This is where difficulties begin. Unlike the relatively orderly air transport system, where tickets are purchased in advance, signs are clearly marked, no one lets you on the plane with the wrong ticket, ground transport is often not thought through though.

If you have arranged a package tour, or have someone to greet you at the airport, your problem is solved, you are not on your own, but have a handler who will take care of you. If you are on your own, you need to decide between taxi, limousine, shared-ride taxi, hotel shuttle, rental car, or public transport.

Unlike the inside of the airport, the signs here are quite chaotic. The ground transport lobby or the roadway just outside the airport are still a regulated form of capitalism in most US cities. Outside the US, in some airports, agents do not merely standing behind counters, but rather go up to you and try to recruit you to their form of ground transport (which is undoubtedly more expensive than going market rates). The trade-off is the service they provide (first and foremost not having to continue to think about the decision, second, the vehicles are often higher quality, and third, it hopefully gets you to your destination faster). If you choose a rental car, hope that you made a reservation ahead of time, as walk-up fees are considerably higher. If you wish to take public transit, you will often have to catch another shuttle just to get to the public transport terminal, and then figure out which route you need.

And we have yet to leave the airport.

14.3 *Design for 360 degrees*

Originally published as Levinson, David (2012-08-27) View from the train.

Train stations (and to a lesser extent airports are marketed as important to the 'Image of the City,' and that we need a grand gateway to attract or welcome visitors. Yet think about this. If you are already on a train arriving in the city, you don't need to be attracted. And your welcome is not the building's front edifice, but instead its unseemly backside. As you approach the station you are inevitably passing through the lower rent industrial areas of of the city (what else would be near the nuisance of train tracks without the benefits of accessibility), areas which are often strewn with litter and festooned with graffiti on concrete walls.

If you really want to welcome visitors, you would not restore the head house, but instead the arrival path. The head house may send visitors on a magnificent farewell, but is no place for a grand arrival, all arrivers want to leave the train station as fast as possible after arriving.

(a) St. Pancras Station, London, UK

(b) Rotterdam Centraal Station.

(c) The unseemly backside of a train station in Amsterdam, Netherlands.

Figure 14.3: Train stations. St. Pancras Station photo via Wikipedia. Other photos by author.

14.4 *Transit interfaces and the first time user*

Originally published as Levinson, David (2013-10-21) Feels like the first time: Transit interfaces and the first time user.

Having left their port of entry (the airport or train station), the visitor often seeks to move from the port of entry to where they are staying (e.g. a hotel). Most airports have taxi services of some kind, but the urbanist traveler wants to take public transit.

I recently had the opportunity to reclaim my transit virginity on a trip to Copenhagen. I arrived at the airport on Saturday afternoon, collected luggage, exited customs and found my way to the rail platform. I picked the rail (S-train) platform instead of the Metro platform more or less by mistake (in retrospect, I should have taken the Metro). Fortunately I could buy tickets with my international credit card. Unfortunately, my cell phone's data plan was insufficiently international to be helpful. There was a proof of payment system, but I was not checked.

Figure 14.4: Copenhagen bus stop information kiosk. Photo by author.

As the train approached the Central Station, there was an announcement that the train did not go to Nørreport station, and to use a bus instead. I missed the bus number which I heard as mumble A, which in fact was 1A, but I didn't catch that so got on the 5A. (Most of the bus numbers end in A, I don't know why). (In retrospect, I should have just walked to my destination). The bus driver accepted the rail ticket on the bus system. Unfortunately the bus went in a direction orthogonal to my destination. Fortunately I got to see some interesting working class areas of Copenhagen, all of which did have side bike paths, which were widely used, some evidence for the 'Field of Dreams' hypothesis – If you build it, they will come. Fortunately, I did figure out this was the incorrect bus quickly enough, and exited, and found a bus stop. More fortunately, the bus stop had a system map. Hallelujah.

I figured out which buses I should take (4A to 5A or 150S), and after a third bus trip, wound up outside Nørreport station (which is actually the country's busiest). Now to figure out where is my hotel. Fortunately I had a local area map. Unfortunately not all the streets were marked. Fortunately there are local maps at kiosks on the streets. Unfortunately, streets change names every block. Even more unfortunately, many different streets (some parallel, some perpendicular) are called 'Shopping Street' ('Strøget'). I must have walked the entire system before I found my destination.

I did not use transit the next day.

On Monday, we were advised by conference organizers to use the bus to get to DTU (Technical University of Denmark), where the conference was. We were advised to catch a particular bus from outside Nørreport. There are many, many buses converging here,

(a) Copenhagen Movia Bus on a Saturday afternoon.

(b) Crowded Bus stops at Nørreport Station.

(c) Nørreport Metro Station (Copenhagen) is very crowded in rush hour.

Figure 14.5: Local transit in Copenhagen. Photos by author.

the station was under reconstruction, finding the right bus is tricky, much less the right one in the right direction. The bus stops were mobbed, the sidewalks were filled with Danish people waiting to board the very frequent public transit.

The more crucial question was how to get a ticket to use the bus. Getting a ticket at the airport was fairly straight-forward. Where were the bus tickets at the bus stop? Well, in the train station of course. We were advised to get a multi-day pass (since the conference was multi-day, and there would be return trips). Those were not being sold by the machines. I bought two tickets, one for the return. It turns out the tickets have a time limit on them (I think 3 hours from time of purchase). While I was struggling to figure out how the ticket machine worked, a Dutch researcher going to the same conference was having the same struggles, and though we had never met, asked if I was going to the same conference. Smallish world.

We bought tickets, found the bus stop, got on board the bus. The next trick is figuring out where to get off. This we only managed by luck (most passengers were exiting at the stop nearest DTU) since the bus did not actually identify the bus stops (I think it was supposed to, it was a modern bus with lots of information systems, it just didn't). Worse, the stop did not say something obvious like DTU (which was a block away and across the freeway), but instead the name of the local street we had never heard of and was not on the map. It is the stop after Ikea.

On Tuesday I was such a pro, I could help another conference goer who I met on the bus (who was using it for the first time) get to our common destination (still sort of a smallish world). I used the second ticket I bought the previous day (having gotten a ride home the night before), obscuring the date and time with my thumb. Yes,

that makes me a transit scofflaw, a fare jumper ... but I did pay for the ticket, so I felt morally justified.

I took a taxi on the airport return.

Next stop Netherlands. I landed at Schiphol (a convenient non-stop connection from Minneapolis) and needed to travel to Arnhem. There are convenient ticket machines at Schiphol airport, which take international credit or debit cards, or cash. All good. I even figured out which rail cars are 1st and 2nd class (the 1 and 2 painted on the side of the train are the class number, not the carriage number). I am sure I paid the 'foreigner tax' and could have gotten cheaper tickets somehow if I were a local, but *c'est la vie* or perhaps *dat is het leven*.

When going back to Schiphol at trip's end, I was leaving from Zaandam. The ticket machines there require a European debit card with Chip and PIN (different than the magnetic stripe based American debit or credit cards in use at the time), or cash. There is a ticket agent (for certain hours), who also required the same payment mechanisms. The ATM machine at the station did not work at all. Fortunately there was an ATM near the station (down the steps). Unfortunately the security agents at the station would not let me leave my suitcase (damn terrorists), so I needed to bring it down, and back up, the steps. Then I paid the agent cash, and went down another set of steps to the platform.

Similarly, the transit and rail systems in the Netherlands generally work very well (aside from a 3-hour delay due to 'Person under Train').

Still, the interface issues dissuade first time users from using transit. In a transit-intense place like Copenhagen, there are few first-timers, and most of the visitors will not venture onto local transit since the learning curve is steep and its downstream value small (I at least get a small book section out of it) since time in Copenhagen is short for non-residents.

Language barriers and currency barriers dissuade international users from local transit.

The systems are not merely optimized for regular users (which is appropriate), they are very difficult to use for non-regular users. This is a huge barrier to entry. Where transit use is low, this is unfortunate, and will keep use low.

14.5 *Interaction design and the bus stop sign*

Originally published as Levinson, David (2013-11-18) Towards a first-class bus system and Levinson, David (2006-05-09) Towards an urban interface: some design principles.

The seemingly ubiquitous and mundane bus stop sign is found in urban areas. It tells prospective passengers where to wait to board the bus, and tells passengers on the bus (and the driver) where to stop so they may alight. Before the bus stop sign, buses (and streetcars and horsecars and omnibuses before them) would stop anywhere along the route. (The emergence of the fixed route is another story.) The passenger of a horsecar would pull on a rope connected to the driver's arm to request a stop. This was more efficient than yelling in a noisy environment. The driver would just stop. Passengers seeking to board would flag down the bus-like conveyance, like hailing a taxicab in Manhattan, and the vehicle would stop nearby.

The sign brought order to the chaos. And if there were only one route on a given road, and everyone knew where it was going and when it went there (or it ran at high frequency that schedule didn't matter), a sign saying 'Bus Stop' might be all you need. But as systems grew, they became more complex. They branched at the ends. Routes joined and diverged. Some sections of road might see several, or dozens of routes serving them. Conveying that information to travelers is of high value, because not only will travelers not get lost, they might find additional value in the system, using it to connect to places that require transfers.

Donald Norman, a key thinker in user interface for objects has written[1] about 'fundamental principles of interaction design that are completely independent of technology' [which are shown in the first column of Table 14.1, application to bus stops is shown in the second column]:

[1] (Norman and Nielsen, 2010)

Bus stop signs are information for travelers. They are also marketing to potential travelers. For every time someone sees a bus stop sign when making a trip, hundreds pass by who are not making a trip. They may still look at the sign and see information. Over time that information will sink in, and they will get a sense of what routes go where. People will begin to develop mental maps of the transit system. It will give them confidence to use the system that a simple 'Bus Stop' sign does not.

The bus stop should have the following information (in order of importance):

1. Station name (legible from on-board),
2. Routes serving the stop,
3. Destinations reachable from the stop,

Norman's Principles	Application to Bus Stops
Visibility	What do people see about their environment, do they know where the bus stops, what happens when they get on (where does it go), when does it operate, how long will they wait?
Feedback	When they go to the bus stop to wait, does a bus come?
Consistency	Does the same thing happen every time, or does the bus not come on weekends? Do they pay for it the same way each time?
Non-destructive operations	Can I get off the bus and get back to where I started?
Discoverability	Can I figure out where the bus goes based on the bus stop sign?
Scalability	Does the same information apply at all stops, or do some stops have more than others?
Reliability	Does the bus come on time?

Notes: *Visibility* is also called perceived affordances or signifiers. *Consistency* is also known as standards. *Non-destructive Operations*: Hence the importance of undo. *Discoverability*: All operations can be discovered by systematic exploration of menus. *Scalability*: The operation should work on all screen sizes, small and large. *Reliability*: Operations should work. Period. And events should not happen randomly.

Table 14.1: Principles of interaction design.

4. Frequency of service,

5. Range (Hours) of service,

6. Schedule of service,

7. A way to flag the bus at night (a light at the top of the sign, e.g. a glowing red 'T', with a call button),

8. Map of routes serving the stop,

9. Map of the neighborhood around the stop, including other bus stops,

10. Real-time information on when the next buses will arrive (or lacking that, A QRS code linking me to real-time information), and

11. Instructions for using the bus system (fares, transfers).

It should ideally also have off-bus pre-payment to speed boarding, a bench, shelter from the elements, and heat for the winter, but that is beyond information.

These things are standard in many European cities, where transit is taken seriously. In London, all the stops have the information described. In Helsinki all the stops have the above information and shelters. There are many design details. There is no guarantee that

London or Seattle or the new Minneapolis sign has the perfect answer.

How much does this cost? Of course the answer is it depends. There are lots of factors. But let's imagine it costs $2000 per bus stop to design, print, and install decent, London-level signage (not including benches or shelters). London has a bus stop average cost of replacement of £1475.[2]

For 13,000 signs, this would be $26 million. This of course would need to be updated as information changes, so let's assume $100 per year (or $1.3 M) system wide, since not all information changes at every sign every year, most details remain the same. This is well less than the cost of 1 mile of LRT, or the cost of 2.5 parking ramps[3], and benefits the whole system.

Is this worthwhile? The evidence suggests yes.[4]

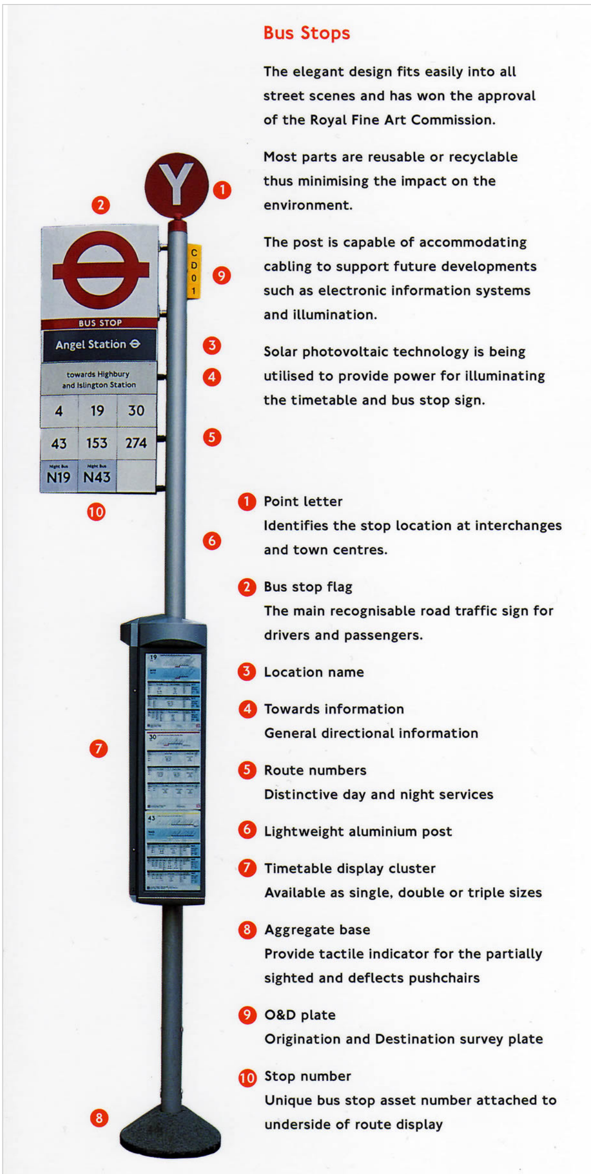
Network effects suggest this needs to be done everywhere to be fully effective, not just at selected origins. To be willing to use transit for spontaneous action, I need to have confidence that not only I can get on the right bus where I am starting, but get on the right return bus at my destination.

[2] Source: Bus stop/shelter replacement costs (Earle, 2012).

[3] A parking ramp is the Midwestern term for parking structure (garage).

[4] (Currie and Wallis, 2008).

POSTSCRIPT: In late 2014, Metro Transit announced it would begin to replace their uninformative signs with somewhat more informative signs. Some signs have been changed, this is expected to be completed in 2017.



(a) Detail of London Bus Stop Sign. Source: courtesy Transport for London

(b) Minnesota Metro Transit Bus Stop before and after (promised). Source: courtesy Eric Roper, StarTribune. 'Building a Better Bus Stop.'

Figure 14.6: Bus stop signs.

14.6 *Landmarks foster a sense of place and navigability*

Originally published as Levinson, David (2006-09-13) In praise of landmarks.

Figure 14.7: Coca-Cola Headquarters, Atlanta, Georgia.

I recall, as a really green 17-year old freshman at Georgia Tech, taking a night course and leaving Lyman Hall Laboratory of Chemistry for the first time. I exited through a door different from where I entered. I was briefly disoriented and completely turned around from where I expected to be. I started off in the wrong direction until eventually I located the Coca-Cola headquarters (just southwest of campus on North Avenue) (Figure 14.7). While I still didn't know exactly where I was, I could figure out where I was going.

We navigate spatially and visually. Cities without redeeming art, architecture or natural landmarks are unpleasant. Not merely because they lack 'charm' and the buildings are individually dull, but because of their collective undifferentiatedness, which creates difficulties for navigating (especially if they also lack some spatial regularity like a comprehensible grid network) and spatially locating oneself. Being lost (both not knowing where you are and not knowing either how you got there or how you will get to where you are going) brings a strong sense of unease that creates frustration if not hostility to the place where you are lost.

Cities landmarks, visual identifiers on the landscape, so that people can explore them. The nature of the best identifiers changes if you are walking, biking, taking transit, or driving, as you view it at different speeds and different resolutions.

Skylines have value, more than the simple value to the owner of the individual building. In economic terms, they provide some positive externality, collectively exhibiting a network effect where the whole is larger than the sum of the individual parts. Measuring this is of course difficult.

When I am driving around, and see the skyline in the distance from a particular angle, I instantly know what direction I am going (inbound). While some of these benefits may be obviated with in-vehicle navigation, the certainty of physical structure outweighs the digital outputs of a machine.

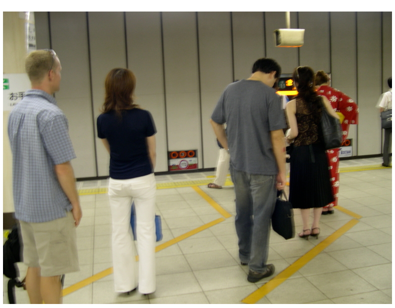
Figure 14.8: Kitchen Town, Tokyo, Japan.

14.7 *Train station markings*

Navigation is not only about signs. Markings on the ground of various kinds can help. In a complex environment, following the yellow brick road, or in this case the painted color lines, can help get you to your destination. This logic is used in many complex environments, including both train stations and hospitals. Maps on the ground, as well as directional arrows are another solution.

(a) Navigation at London's Victoria Station. Photo by CMG Lee.

(b) The Crunchy Nut Lane - lines on the ground used for marketing, King's Cross Station.



(c) Markings on the ground to control queues at Kyoto train station.

(d) Directional signs in the pavement, Green Line, Saint Paul, Minnesota.

Figure 14.9: Train station markings.

Figure 14.10: Uni-signal traffic light with shapes for the color blind. The principle seems right, the symbols seem wrong. Red should be an octagon, to align with the stop sign. If we use LEDs we could actually spell out the word 'stop' (though this might have trouble in winter). Nevertheless, if humans are to continue driving, this might be an idea worth playing with. Source: Autoblog http://www.autoblog.com/photos/uni-signal-traffic-light/.

[5] (Nielsen, 2004).

14.8 *Standardization*

A typical remote control for Cable TV in the first part of the 21st century has up and down arrows to adjust channels. Pushing the up (plus) button will move you away from channel 0, while the down button will move you toward channel 0 (although if you reach the final channel, you will return to home). But remote controls also have a navigation for the onscreen guide. this has an up, down, left, and right arrow. The up arrow moves you through the onscreen guide, but here up moves you toward channel 0, while down moves you away from 0. The left and right arrows move you forward or backward through time.

These remote controls have a further set of controls to operate an auxiliary device like a DVD or an inbuilt device like a personal video recorder. The left arrow, following the convention from tape recorders, plays (forward in time), while the double left arrow (on the right-most side) is fast forward and the double right-pointing arrow (on the left side) moves you in reverse (rewind). Other buttons do other things.

Complaints about the complexity of modern remote controls are hardly unique.[5]

Like remote controls, keypads are another area where conventions may confuse.

Keypads on telephones and calculators represent the same ten digits, however they have different layouts. The telephone keypad, introduced with the advent of Touch Tone dialing by the Bell System in the 1960s places the number '0' (or letter 'O' for operator, it is not always clear on telephones) at the bottom, and then numbers digits 1 – 9 in three rows of three columns each from the top. A calculator keypad (also used on computer keyboards) on the other hand, while it places 0 at the bottom, numbers 1 to 9 also in three rows of three columns, but in this case beginning at the bottom, as shown in Figure 14.11. These conventions have carried over to computers, which could array numbers in any random way, but use the different conventions to represent the different devices. Newer devices, such as television remote controls, could use either, but typically follow the telephone layout (though some have original layouts themselves, e.g. going from 1 to 4 on the first row, 5 to 8 on the second row, and 9 and 0 on the third row).

American travelers trying to write emails in some European countries may note that the standard QWERTY keyboard found in the English-speaking world (so-named for the keys on the top-row of letters, which was conveniently arranged so that you could spell

(a) Cable TV Remote Control from Charter communications, early 2010s.

(b) Telephone Keypad: 1, 2, 3 increasing from top to bottom, with 0 at bottom.

(c) Calculator Keypad: 0, 1, 2, 3 increasing from bottom to top.

Figure 14.11: Standardization. Source: Wikipedia.

the word ‘Typewriter’ on a single row) has been replaced by a keyboard, which mainly swaps the Y and Z, but has some minor changes, dubbed the QWERTZ kezboard. This is just enough to throw off touch-tzpists (er, typists). I am sure the confusion is two-way.

For operating a television, rarely an urgent activity, the additional cognitive load of a poorly-designed or non-standard interface is annoying, but not dangerous. With the case of election ballots, such confusion and resulting error may change the outcomes. The most salient example is the odd butterfly ballot used in West Palm Beach, Florida in the 2000 Presidential election, resulting in a disproportionate (compared to other jurisdictions) number of votes for Pat Buchanan, and likely giving the state of Florida, and thus the United States electoral college and the presidency to George W. Bush.[6]

[6] (Mulroy, 2001).

For driving cars in the United States, many functions have been fortunately standardized. The brake foot pedal is on the left, the accelerator on the right. The steering wheel itself usually performs as expected. Less critical functions remain confusing, especially when switching cars, or driving an unfamiliar vehicle, such as a rental car, the difficulty compounds as this is usually done in an unfamiliar place. Where is the windshield wiper? The light switch? The brights? The transmission control? The radio? The environmental controls? The locks? The window controls? The rear-view window control? The unlock for the trunk? The unlock for the gas tank? Where is the gas tank – driver or passenger side?

All vary with make, model, and year of vehicle.

Driving on the left or the right is standardized locally, but not globally. As any traveler from continental Europe, North America, or South America knows, things differ on the islands of Great Britain, New Zealand, Japan, the Caribbean, and even the island-continent of Australia. Sweden famously switched from left to right on Dagen H (or 'H-Day'), short for Högertrafikomläggningen ('the right-hand traffic diversion') in 1967 to be compatible with its neighbors. In 2009 Samoa switched from left to right to be compatible with the used cars it imported from Australia, New Zealand, and Japan.[7]

[7] Listen to 99% Invisible podcast episode 215 for the history of H-Day. http://99percentinvisible.org/episode/h-day/

Traffic signals usually report red on top and green on bottom. In some places red is on the left and green on the right. What does it mean when the light is simultaneously red and green? Or red and yellow (amber), or green and yellow? Or the green light flashes? All of these patterns are local, but not global standards.

The turn signal may mean "I want to change lanes" in an urban context. In rural Turkey, and probably other areas, it means "You should pass me."

John Graham-Cumming writes:[8]

[8] Graham-Cumming, John (2010-06-21) The Elevator Button Problem. JGC.org http://blog.jgc.org/2010/06/elevator-button-problem.html.

> User interface design is hard. It's hard because people perceive apparently simple things very differently. For example, take a look at this interface to an elevator:
>
> Now imagine the following situation. You are on the third floor of this building and you wish to go to the tenth. The elevator is on the fifth floor and there's an indicator that tells you where it is. Which button do you press?
>
> Most people probably say: 'press up' since they want to go up. Not long ago I watched someone do the opposite and questioned them about their behavior. They said: 'well the elevator is on the fifth floor and I am on the third, so I want it to come down to me.'

Standards are pervasive (imagine if each car required a different gas nozzle at a gas station (beyond the obvious differentiation for leaded and unleaded).

But what in the world could be standardized and produce coordination externalities, but just has not been because the institutions for such organization have not yet been established?

15
Instruments of Control

Figure 15.1: A shared space street in Bern. Source: (Kaplan, 2009).

Originally published as Levinson, David (2014-09-10) Safety is a shared responsibility.

Be robust to human imperfection. In the constant exhortations to pedestrians around cars and trains, we hear 'Safety is a shared responsibility.' This of course is true. Many crashes are the product of a chain of failures. The driver was shaving or putting on makeup. The bicyclist was too fast for conditions. The pedestrian was looking for Pokémon. Someone else braked sharply, and someone behind them swerved because they were following too closely and hit a third person. And so on. Yet authorities are often quick to blame the victim and thus finding fault in others, or the stars, rather than the system design and thereby finding fault in themselves.

The more you hear the exhortation, the less effective it becomes

(diminishing returns set in), much like the omnipresent 'Threat Level Orange' airport pronouncements of the George W. Bush era.

People are imperfect. They feel they have better things to be doing then looking out for lurking dangers around every corner. They did not evolve to operate in a city with multi-ton machines operating at speeds faster than the fastest land animals. They see meaningless signs and signals and learn to ignore them. Breaking traffic and pedestrian laws may be illegal, but it is hardly immoral – we don't feel guilty when we conscientiously don't allow ourselves to be governed by degrading light bulbs implemented by unthinking bureaucracies.

Designs for systems that involve people should consider human imperfection. Ideally systems are forgiving of human error. Light rail trains, e.g, are much more dangerous than buses. (Cars are too). They are far less tolerant of imperfection, as they can neither brake quickly (due to mass) nor swerve (due to tracks), and are more deadly on impact (again due to mass).

There are two good strategies for multi-modal travel within a finite space:

- keep them separated, and
- mix them slowly

The third strategy: mix them quickly will lead to tragedy as long as people are making decisions, rather than machines.

The 'keep them separated' strategy is why safety on interstate highways is much better than other streets. High speed vehicles are interacting with other high speed vehicles going in the same direction, but not in the opposite direction, and low speed vehicles are prohibited. It is far from perfect, but better than the previous alternative. So much so that when US speed limits were raised in the 1980s, overall safety went up as drivers were attracted off much more dangerous roads onto the interstate, which was only marginally more dangerous with the higher speed limit, and now less likely to result in a speeding ticket. [1]

[1] (Lave and Elias, 1994).

Newer subway systems have glass barriers preventing people from accidentally falling on the track. One example is the shuttle at the Minneapolis - St. Paul Airport. Despite running one train every 90 seconds or so for over 10 years, I have not heard of any incidents with this system.

Yet, most mid-sized American cities have chosen, for the most part, not to build grade separated transit systems. They are certainly more expensive, even if more beneficial (safer and faster). That leaves the strategy of 'mix them slowly.' This mixing is usually

what telecommunications engineers would call 'multiplexed.' They share a resource, a conflict point in space, but that sharing is divided into different time channels. Clearly two objects cannot occupy the same space at the same time (when they do, it's a collision). But long engineered buffers between vehicle flows to ensure safety creates delays and wastes capacity, and privileges one form of transport over another. The next chapter, *Shared space*, looks at a less-engineered approach, as illustrated in Figure 15.1.

In short, design matters. Over-engineering can be as great or even greater sin than under-engineering. The best design is not necessarily more gadgets, instructions, rat runs, prohibitions on actions, closing of desire lines, or other devices constraining people from their intuitions.

Rather it is running with and shaping travelers natural instincts, so the environment is not chafing but accommodating. Safety is a shared responsibility, and those who diminish the effectiveness of safety tools such as signs and signals by their overuse, misuse, and excessive exhortations which loosely spend people's scarce attention are culpable as well.

15.1 *Begging for simplicity*

Originally published as Levinson, D. (2013-11-25) Begging for Simplicity and Levinson, D. (2014-06-18) Don't Walk.

> 'Making pedestrians press buttons to cross streets is the death of the city' – Eric Fischer[2]

[2] Quoted by Eric Griswold at #Transpowest on Twitter. (Eric Fischer @enf) (2013-11-16)

Pedestrian actuators, nicknamed 'beg buttons' for the supplicant role they impose on pedestrians, call for a pedestrian signal at an intersection (Figures 15.2 and 15.3).

Traffic signals on streets with sidewalks (which implies pedestrian traffic either exists or is desired) should *always* have an automatic walk phase, just as every cycle gives green time to cars from every approach. (This is especially true in areas, like a college campus, or really any area with a measurable number of pedestrian, which has a plan that aims to prioritize walking.) Actuators are fine if they make the walk signal come sooner, but being unpushed should not be used as an excuse not to have a walk phase at all. Car drivers don't have to go out of their way to press actuators, why should pedestrians?

The beg button operates in different ways in differing conditions. In some cases it calls for the pedestrian signal so it comes quicker, and they also tell the controller to extend the green time (and parallel walk signal) given to a phase to be sufficiently long to allow pedestrians to safely cross. In other cases it extends the green light (for cars) so the pedestrian walk signal can be activated, but does not affect when the green light comes. In many cases they are broken. In those cases it may never give a walk signal. (There are solutions where the default state of broken is 'on' – always give a pedestrian phase – instead of 'off,' but that

(a) Don't Walk 1: Washington Avenue at Union Street. Just west of the East Bank station, I see a pedestrian signal telling me not to walk in the landscaped median area from east to west. There are no through roads for traffic either to the north or south of Washington here, since Union has been closed at Washington.

(b) Don't Walk 2: Green Light. Are they concerned I will move east-west parallel to a moving train or bus?

(c) Don't Walk 3: Washington Avenue at Church Street. Just west of the East Bank station, again there is no regular motorized cross traffic here, since Washington Avenue is a pedestrian/transit mall

Figure 15.2: Don't walk.

Figure 15.3: Beg buttons.

(a) Beg Button 1: Decommissioned Walk Button (Repaired 18 days after being reported).

(b) Beg Button 2: Replacement (Franklin and Seymour)

(c) Beg Button 3: The intersection of Beacon St. and Harvard Avenue. This beg button on the University of Minnesota campus reports a time exemption, implying that the actuator need not be pressed between 8 am and 6 pm weekdays. This time exemption was removed since the photo was taken. This improves the previous situation (pushing the button in the middle of the day). This intersection has little traffic and doesn't warrant a signal.

(d) Beg button 4: Franklin Avenue, East River Road, and 27th Avenue SE. This actuator gives instructions for something that should be tacit. That it is not tacit indicates it is a flawed design. If I can read the instructions, I already know how to cross a street. It is not like pedestrian actuators are a new technology. While I want more information at bus stops, crossing a street should be straight-forward, and not require an 11 line instruction set with five graphics. Sadly there is more information here than at the nearest bus stop.

15.2 *Flipping signals*

Figure 15.4: Shibuya, Japan employs a Barnes Dance.

Originally published as Levinson, D. (2014-05-07) Flipping Signals.

In places that are, or want to be, walkable, and serve pedestrian traffic, traffic signals should have a default setting of pedestrian scramble (or Barnes Dance, as in Figure 15.4), and only switch to a green light for motor vehicles from a particular approach (for a short time period) when it is actually actuated by a vehicle. Buses and emergency vehicles would still be able to get priority by signaling from upstream.

Traffic signals are usually designed with the objective of minimizing motor vehicle delay, yet many policies and plans have a stated aim of reducing the amount of vehicle miles traveled or the automobile mode share. How does lowering the cost of driving and increasing the cost of every other mode help with that objective?

Instead of placing pedestrians in the supplicant position of begging for a green light, let's give walkers some dignity, and allow them to simply purposefully walk, or even amble rather than 'scramble.' If we had a world where cars had to wait for pedestrians, vehicle delay would undoubtedly rise. But vehicle counts would fall, and pedestrian demand would rise. Where would the vehicles go, would they disappear or reroute?

Think about places this would work in your community. The measure of success would be change in pedestrian and bike counts, and the reduction in vehicle counts.

15.3 *You don't have to live like a refugee*

Originally published as Levinson, D. (2014-07-17) You Don't Have to Live Like a Refugee.

Listen, it don't really matter to me baby
You believe what you want to believe
You see you don't have to live like a refugee (Don't have to live like a refugee)
Yeah Somewhere, somehow, somebody
Must have kicked you around some
Tell me, why you wanna lay there
Revel in your abandon
It don't make no difference to me baby
Everybody's had to fight to be free
You see you don't have to live like a refugee (Don't have to live like a refugee)
Now baby you don't have to live like a refugee (Don't have to live like a refugee) No! [3]

[3] Tom Petty & The Heartbreakers (1979) *Refugee*. Lyrics from MetroLyrics.

Tom Petty speaks not of the oppressed living in third world conditions, but rather his girlfriend. The lyrics however apply to the pedestrian trapped on refuge island between two stream of traffic.

The pedestrian refuge island (Figure 15.5) allows the pedestrian to cross some of the lanes of a roadway without crossing all of the lanes of a roadway. If the lanes are going in two directions, this might decrease the travel time to cross the street, by increasing the likelihood of finding a safe gap in traffic (since you are more likely to find an acceptable gap in one lane than two lanes) and reducing the number of objects the pedestrian is looking for.

The refuge island is presumably a safety improvement.[4]

[4] (Retting et al., 2003)

So far, so good – safety first and all. However, the existence of the refuge island makes it possible for the traffic engineer, and worse the driver, to even further subjugate the needs and rights of pedestrians. It creates an environment where the pedestrian must seek refuge from oncoming traffic, which implicitly has the right-of-way, rather one where the motor vehicles must yield to pedestrians who seek to cross.

This is a problem of first-best and second-best. In a second-best world, where pedestrians have no rights, this is the literal life-jacket being thrown to them so they don't sink in the traffic stream. In a first-best world, there would be no stream in which to sink. Life should not be a game of Frogger.

Figure 15.5: Refuge Islands.

(a) Pedestrian refuge island, Hyde Park, London, preceding the onslaught of the motorcar (via Flickr).

(b) Charlotte Complete Streets-Rozzelles Ferry Road 'Charlotte completely revamped Rozzelles Ferry Road. The streetscape was enhance by the addition of street trees and planting strips, while pedestrian crossing opportunities–as indicated by the crosswalk and corresponding refuge median–were added along the length of the road to make walking a breeze. The bike lanes facilitate cycling on road that was previously unsuitable for riding.' Photo: Charmeck.org (via Flickr, Creative Commons license).

15.4 *You can't live like a refugee – Do not wait here. Do not wait there. Do not wait, anywhere.*

Recently I found myself seeking refuge where no island granting refuge exists. Probably starting the crossing later than I should have, I crossed University Avenue half-way before my walk signal went to solid red, stranding me between the tracks of the Green Line (I could have illegally run in front of the cars, but one never knows).

I waited an interminable amount of time, for which I could have accepted a gap, playing Crossy Road as a first-person character. I would have if I had more information about where cars were, but couldn't see well because of line of sight and cars in the turn lane.

A train approached from the left of me. A train approached from the right of me. I don't exactly know how much space is between the trains, but not terribly much. The train to the left of me blared its horn (so loud I could hear it from more than 1/2 mile away), afraid I might not see it and become another statistic. I moved slightly forward. It passed (without braking as far as I could tell). The train to the right of me blared its horn. I moved backward. It passed (also without braking). Fortunately they did not pass simultaneously.

Because of me, MetroTransit has now emblazoned the non-refuge area between the tracks at signalized intersections on the Green Line with a 'Do Not Wait Here' marking (Figure 15.6).

Figure 15.6: Do not wait here. Do not wait there. Do not wait, anywhere.

Obviously, pedestrians are flawed for being so fool-hardy as to be pedestrians, or trying to cross a street on the blinking 'don't walk', or just being slow, or distracted. But I am not the only one.

Clearly there is also a design flaw in the signalized pedestrian crossings failing to understand human actions, which a spray painted template will do little to alleviate. There is a flaw in traffic signals that do not recognize there is a pedestrian in motion. Such a marking is, literally, the least they could do to address this problem.

The recommended approach seems to be:

Step 0. Don't cross University Avenue.

Step 1. If you do cross University Avenue, then don't get stuck in the median of the tracks.

Step 2. If you are stuck in the median at a red light, then pray.

(Actually, you probably would stand where the foot steps are, since that is in the middle, but then it says, do not wait here).

If you do not wait here, where are you supposed to go, in front of the train?

What if there were a lot of people on the island, not just a few. There might not be enough space. Would the train stop then? I am convinced this has not actually been thought through.

15.5 Sidewalk obstructionism

Originally published as Levinson, David (2012-11-15) Sidewalk Obstructionism.

On my usual commute home, I have recently faced this *Do Not Enter* sign on the west entrance of the newly remodeled and rebranded Commons Hotel. The sign, aimed at convincing drivers not to enter the driveway the wrong way, was placed in front of the sidewalk curb cut, sandbagged so it did not blow down. I asked a staff member of the hotel about it (I made him come out and look), and while quite gracious, he said it was the University of Minnesota's doing. He promised to call them. Two days later, nothing had happened. I don't know if he didn't call, or if he was routed to the University's Department of Sidewalk Operations, Obstruction Division, Do Not Enter Unit, and they did not do anything. A sign in the middle of a street would have been moved if not run over.

You might say, just walk on the other side of the street. But cars disgorge from the Washington Avenue Ramp, and it is even more unpleasant. Or walk around it (which I did), but that is inefficient for all concerned, and impossible for wheelchairs, who are forced into the street or driveway.

I moved it myself. Why does that feel illegal? I hope the rain or something else takes care of the loose sand.

Surely there is a design to convince drivers not to go the wrong way on a one-way driveway than an ugly sign, though it might require some concrete. We need better self-explaining roads and driveways.

The example in Figure 15.7 was easily resolved. In contrast, permanent obstructions in sidewalks: fixed signs, telephone poles, parking meters, bike racks, sidewalk cafes worsen the condition of the pedestrian by narrowing their path and diverting them from the straight and narrow. That is needless inconvenience. For those who are physically disabled, as in a wheelchair, it might be *eliminating access* altogether. Figure 15.8 show sign poles in the middle of the sidewalk. While such a pole does have the merit of being useful to break a fall when the sidewalk is icy, it also makes the sidewalk too narrow. The sidewalk here was probably also too steep. Sadly, despite a recent road reconstruction and restriping, this sidewalk was written off as too difficult to fix. The signs were not moved despite unused street pavement immediately adjacent.[5]

[5] For an illustration of the effects of sidewalk obstruction on persons in wheelchairs, see this YouTube video https://www.youtube.com/watch?v=_W3QZjKaK_4 created in the early 1990s.

(a) Sign found at The Commons Hotel 'Do Not Enter' aimed at motor vehicles blocks pedestrian path.

(b) 'Do Not Enter' aimed at motor vehicles no longer blocks pedestrian path.

Figure 15.7: Temporary sidewalk obstructionism.

(a) No parking sign obstructs sidewalk.

(b) Railroad sign for essentially abandoned rail line still blocks sidewalk.

(c) Railroad crossing sign narrowing sidewalk.

Figure 15.8: Permanent sidewalk obstructionism. These signs are found in sequence on Franklin Avenue, SE, Minneapolis.

15.6 *Walking in the street is highly dangerous and prohibited by law*

Originally published as Levinson, David (2012-10-11) Walking in the street is highly dangerous and prohibited by law.

Figure 15.9: Sign found at 'The Station on Washington' at Washington Avenue Transit Mall and Walnut Street. 'Walking in the street is HIGHLY DANGEROUS and PROHIBITED by Law'

I saw this sign (Figure 15.9) at a new construction project 'The Station on Washington' at Washington Avenue Transit Mall and Walnut Street.

I don't disagree that walking in the street is 'HIGHLY DANGEROUS.' Is it really 'PROHIBITED' though? If I park on the side of the road, must I exit through the passenger door? If so, it is the least enforced law on the books. I know the sign is not official, I can tell from the wrong typeface and mixed use of capital and lowercase letters.

The City of Minneapolis[6] tells me that 'Mid-block crossings are illegal if there are traffic signals at both ends of the block.' also 'State statute requires pedestrians crossing mid-block (between 2 intersections) to yield to vehicles, unless a mid-block crossing is marked.' That is not the case here, only at one end is a traffic signal. They also give me the tip 'Always walk on the sidewalk; if there is no sidewalk on either side of the street, or if the sidewalk is inaccessible, walk facing vehicles.'

The actual law says:[7]

> Subd. 5. Walk on left side of roadway. Pedestrians when walking or moving in a wheelchair along a roadway shall, when practicable, walk or move on the left side of the roadway or its shoulder giving way to oncoming traffic. Where sidewalks are provided and are accessible and usable it shall be unlawful for any pedestrian to walk or move in a wheelchair along and upon an adjacent roadway.

So if a sidewalk is provided and accessible you do have to use it. Should not a sidewalk be on both sides of the road to be 'accessible'? This does not answer the question about exiting a parked car. Maybe I should climb on the roof to avoid walking upon the adjacent roadway.

At any rate, to my disappointment, the sign is not actually lying.

Which moves us to the next question: why does a developer (Opus), pitching itself as transit friendly, get to close a sidewalk in an existing pedestrian district? Why are they not taking space from motor vehicles to create a temporary sidewalk? It is standard operating procedure for construction projects to take sidewalks from pedestrians, in order to leave lanes for cars. The converse should be the case.

6 (Minneapolis Public Works, 2011).

7 Minnesota Statutes 2005 169.21.

15.7 *One way to deal with a desire line: A trilogy.*

Originally published as Levinson, David (2014-09-29) One Way to Deal With a Desire Line.
Levinson, David (2015-07-07) A Tree Dies in Minneapolis, or 'One Way to Deal with a Desire Line' Revisited.
Levinson, David (2015-10-12) The Empire Strikes Back, or 'One Way to Deal with a Desire Line' Redux.

[SEPTEMBER 29, 2014 : ONE WAY TO DEAL WITH A DESIRE LINE.] Desire lines show where travelers want to go (and where they don't). They are visible as dirt paths across grassy fields. More transiently, Winter's white powdery landscape will reveal where travelers want to go. The aim of transport network designers should be to efficiently serve travelers. Desire lines save the designer of all the trouble of figuring out where travelers want to go, it isx manifest on the ground. If only designers would recognize it. I will illustrate this point with a local example.

Figure 15.10a is an aerial shot of the former environment around the McNamara Alumni Center on the University of Minnesota campus, Figure 15.10b is the after figure. Figure 15.10c is in front of (behind) McNamara . Though there is a sidewalk just on the right of this image, pedestrians prefer the straight line path between the Scholars Walk and the diagonal path across Walnut from Beacon Street to the intersection of Oak Street and Washington Avenue. And why shouldn't they? It's cold outside. The extra few feet (extra few seconds) are not worth it, even for a cleared path.[8]

The 2009 Campus Master Plan for the University of Minnesota is a very clear document regarding transportation. It *prioritizes* pedestrians, as is completely appropriate for a campus. There is nothing about '*modal balance*' or other nonsense.[9]

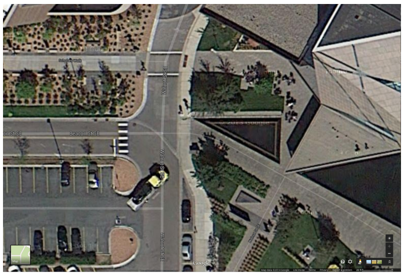
Guideline 35 says:

> Develop pedestrian connections that will:
>
> - Continue to share corridors with other modes of movement along streets or paths;
> - Enable pedestrians to take the most direct route between major destinations;
> - Prioritize pedestrian movement over other modes of travel whenever possible.
>
> Guideline 57 says:
>
> - Design signature streets to accommodate all modes of travel, with walking as the highest priority followed by bicycling, transit, and private vehicles.

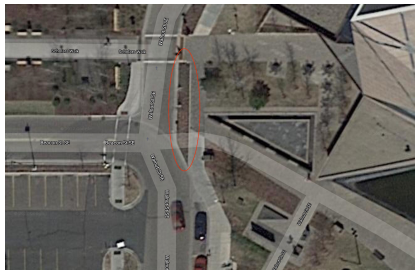
So you would think when a desire line emerges, it would be considered for improvement since it is evidence of a direct route. Certainly you would think direct paths would be preserved rather than removed.

[8] If 1200 people are each delayed three seconds, that is 1 person hour per day that is lost. I don't know the pedestrian count, but that seems the right order of magnitude. (I know, this is America, and we don't value the pedestrian's time).

[9] I was involved with the development of transportation elements of the plan. I was also an employee of the University.



(a) In this Aerial photo via Google Maps you can see what the scene looked like before the recent 'improvements'. Pedestrians could walk diagonally across Walnut to the Scholars Walk.



(b) In this Aerial photo via Google Maps you can see what the scene looked like after the recent 'improvements'. Pedestrians cannot walk diagonally across Walnut to the Scholars Walk.

(c) Desire line at McNamara Alumni Center.

(d) Desire line interrupted at McNamara Alumni Center.

(e) A tree! That's how we solve a desire line.

Figure 15.10: One way to deal with a desire line.

Sadly, this desire line used to be the regular sidewalk path until recent landscaping work done at the McNamara Alumni Center. But the people (well about 20% of the people based on my springtime count) could not be kept down by a mere four inches of concrete, they rebelled, in the typically passive-aggressive Minnesota way, by walking across the desire line rather than the rat run of the planner, especially in Winter when the curb is so conveniently hidden under snow, but even in summer, when there were dying plantings showing the ineffectiveness of the curb.

Still, I complained to campus facilities staff about the remodeling (1) making it a worse pedestrian condition, and (2) flying in the face of the campus master plan.

I am told this change was to slow down bicyclists coming from Washington Avenue to the Scholars Walk. I personally never noticed much of a bicyclist problem on the Scholars Walk, and there is Beacon Street right next door (and now Washington Avenue Mall a block away) so I doubt this will continue to be a significant problem. But perhaps a regent encountered a bicyclist.

I am also told that this was not a University of Minnesota, but a University of Minnesota Foundation decision. See the distinction? Me neither. They share the same umn.edu domain and the Foundation Board is in part appointed by the Regents. I am sure this is important for tax purposes or some such.

Staff said they would try to get this fixed. In spring I even met onsite with a campus planner, who agreed there were better solutions. This summer there was to be work here (to fix some poor construction in the remodel I am told), so there was an opportunity to rectify the situation.

Thus I was surprised to see at the end of the past summer a tree planted where once there was a path, and later a desire line despite curbs aimed nominally at slowing bicyclists and actually just extending the trip of pedestrians (if not increasing the likelihood of their tripping). Now I like trees, but I don't see them being planted anew in the middle of streets to slow traffic on campus. So why is it planted where once there was a sidewalk?

Here we have a tree giving the figurative finger to pedestrians who want to take the most direct route between major destinations (like the Stadium Village Campus Connector Bus Stop on Oak Street and the East Bank of Campus, for instance) in direct contravention of the guidelines of the University's official plans.

(a) A sad tree here (June 8, 2015). Note the tree did slightly divert the desire line to the right.

(b) Tree no more, but the desire line remains, as witnessed by the poor grasses that get trampled more than their neighbors (June 23, 2015).

(c) McNamara tree now with rope barrier.

Figure 15.11: A tree dies in Minneapolis, or 'One way to deal with a desire line' revisited.

[JULY 7, 2015: A TREE DIES IN MINNEAPOLIS, OR 'ONE WAY TO DEAL WITH A DESIRE LINE' REVISITED.] In September of 2014, I wrote *One Way to Deal With a Desire Line*, describing the University of Minnesota's attempt to deal with a desire line by planting a tree in the middle and placing concrete curbs to reroute traffic, costing pedestrians several seconds a day each.

Today, we follow up, asking how did that tree do? As shown in Figure 15.11, that tree did badly (Score one for human behavior and the desire to walk in straight lines).

Not only did it do badly, on a path to die of its own accord, the university went and killed it.

And not only did they kill it, they are doing a bunch of construction around those parts again this year. I am not sure why they renovated last year, and again this year, but it is the University.

[OCTOBER 12, 2015 THE EMPIRE STRIKES BACK, OR 'ONE WAY TO DEAL WITH A DESIRE LINE' REDUX.] In September of 2014, I wrote *One Way to Deal With a Desire Line*, describing the University of Minnesota's attempt to deal with a desire line by planting a tree in the middle and placing concrete curbs to reroute traffic, costing pedestrians several seconds a day each. That tree died, as documented in *A Tree Dies in Minneapolis, or 'One Way to Deal with a Desire Line' Revisited*.

Like the King of Swamp Castle in *Monty Python and the Holy Grail* whose castle sank into the swamp, the University has planted another tree. But this time, it is reinforced, with an almost invisible rope line, shown in Figure 15.11c.

That will teach pesky pedestrians trying to get an education and reach classes on-time to take the straight line path that used to be there but was changed because someone once saw a bicycle on the Scholars Walk.

15.8 No parking and de-signing streets

Originally published as Levinson, D. (2013-04-20) No parking and de-signing streets.

I was traveling down St. Anthony Boulevard with my then 3-year old daughter. She was learning her alphabet and noted the letter 'P' on a lot of street signs (like the ones in Figure 15.12. Every time she saw it, she shared her observations:

> 'P with a slash through it,' 'P with a slash through it,' 'P with a slash through it,' 'P with a slash through it,' ... 'P with a slash through it.'

Figure 15.12: No parking sign.

Well, this is one of the joys of parenthood, teaching reading and the alphabet through standardized road signs. But it brings up a relevant policy question:

Why is the default assumption that we give away scarce public right-of-way for the free storage of private vehicles?[10]

[10] For an argument in favor of on-street parking, see (Marshall et al., 2008).

That is, the default assumption could be no on-street parking except where permitted, which would result in fewer signs on St. Anthony Boulevard, and more elsewhere.

There are three aspects of this:

- Scarceness of public right-of-way. Are you not complaining of congestion? Are you not complaining of the cost of maintenance? If we make streets wide enough to store vehicles, we increase their construction and maintenance costs.
- Storage of vehicles. Might we store private vehicles on private land? Would this not increase the cost of private vehicles (i.e. by removing one of the subsidies we do provide to cars)? Would that not diminish the amount of private vehicles (demand curves are downward sloping).
- Free. If you do want to store private vehicles on public land, at least charge for it. This does not require meters, it could involve permits with enforcement.

Now I know we don't want large areas of surface parking lots either, and if we have already built roads that are too wide for the purpose of moving vehicles, we might as well use them for storage, they aren't earning interest doing anything else. But we are not done building and rebuilding roads, why are we building them with the intent of using roadspace for vehicle storage?

Perhaps it should be obvious where parking is permitted (the road is marked as one lane and more than say 15 feet (4.5 m)), and where it is prohibited (freeways, right lanes narrower than 15 feet). Perhaps we need only sign when parking restrictions differ by time of day (no parking in peak hours). Perhaps we can paint the curb instead

of putting up ugly signs, which will be less effective in winter than summer. Perhaps we can change paving materials.

Certainly there are technological solutions with augmented reality which would overlay virtual signs on the environment, and if we all walk around with Google glasses, or their future equivalent, this might eventually happen. And certainly driverless cars will have a lot of this pre-programmed. But given the time it takes to fully deploy these advanced technologies, we are probably 25 years out before we can remove regulatory signs from our environment wholesale. There should be some intermediate solutions that can help us de-sign our streets.

Figure 15.13: Remember, every intersection is a crosswalk. 'Stop for Pedestrians in Crosswalk.' Safety Sign Inc.

Originally published as Levinson, D. (2012-06-11) Marked Crosswalks Considered Harmful and Levinson, D. (2011-10-18) Walk Don't Run.

15.9 *Marked crosswalks considered harmful*

Every time a pedestrian runs across the street in face of oncoming traffic, conditions worsen for every other pedestrian. That pedestrian empowers the driver, giving them reason believe they have the right-of-way and need not decelerate in the presence of a pedestrian. Pedestrians, reclaim your rights to the street! *Walk don't run*. Make the unhappy driver slow for you.

In one instance, at a troublesome, unmarked, poorly-designed crosswalk at the reconfigured East River Road and Fulton St SE in Minneapolis, I observed a pedestrian, who looked to be in his early 60s, felt the need to run to avoid oncoming traffic that just got set loose at the East River Road/Harvard Avenue Intersection stop-sign at about 5 pm. Drivers (University of Minnesota employees most of them) seem to feel that once they clear Harvard, they have reached the Freeway. They have not. Someone should remind them of this. A few of those dorky 'stop for pedestrians' in crosswalk signs, perhaps some stop for pedestrians in unmarked crosswalk signs would be the standard response.

But one pedestrian and one sign can only do so much. There is a much more a systemic design problem.

In 1968 there was a famous Computer Science article 'Go To Statement Considered Harmful.' [11,12]

> 'My second remark is that our intellectual powers are rather geared to master static relations and that our powers to visualize processes evolving in time are relatively poorly developed. For that reason we should do (as wise programmers aware of our limitations) our utmost to shorten the conceptual gap between the static program and the dynamic process, to make the correspondence between the program (spread out in text space) and the process (spread out in time) as trivial as possible.'

[11] (Dijkstra, 1968).

[12] To transportists, Dijkstra is more famous for his efficient shortest path routing algorithm.

In early 21st Century America, pedestrian crosswalks may be marked or unmarked. Whether a crosswalk is marked is functionally based on the whim of the traffic department.[13]

The National MUTCD doesn't have much to say about which roads get crosswalk markings except to say an engineering study should be performed.[14]

[13] (Brookline, Massachusetts Department of Public Works, 2013).

[14] (National Committee on Uniform Traffic Control Devices, 2009).

Interestingly the Brookline document asserts:

> Marked crosswalks are viewed widely as 'safety devices,' and most municipalities give the pedestrian the right-of-way when within them. However, there is strong evidence that these facts prompt many pedestrians to feel overly secure when using a marked crosswalk. As a result, pedestrians will often place themselves in a hazardous position by believing that motorists can and will stop in all

> cases, even when it may be impossible to do so. It is not unusual for this type of aggressive pedestrian behavior to contribute to a higher incidence of pedestrian accidents and cause a greater number of rear-end collisions. In contrast, a pedestrian using an unmarked crosswalk generally feels less secure and less certain that the motorist will stop and thereby exercise more caution and waiting for safe gaps in the traffic stream before crossing. The end result is fewer accidents at unmarked crosswalks.

Implicitly the document blames pedestrians for asserting their rights, rather than drivers for violating them.

Research about driver and pedestrian behavior can be found in (Mitman et al., 2008).

> 'Driver yielding behavior was a statistically significant variable at all six observation sites. For all road types, pedestrians in the marked crosswalk were more likely than pedestrians in the unmarked crosswalk to have drivers immediately yield the right-of-way to them.'

and

> 'Average gap acceptance was a statistically significant variable at five of the observation sites. At all five locations, pedestrians in the unmarked crosswalk were more likely than pedestrians in the marked crosswalk to wait for larger gaps in traffic before crossing. This finding was consistent across all road types.'

I posit that if you are a trained, but human driver, whose 'intellectual powers are rather geared to master static relations' you will generally respect crosswalks. You will believe, just as all stop signs are marked, all legal crosswalks are marked. As 'our powers to visualize processes evolving in time are relatively poorly developed' you will disrespect unmarked crosswalks, since if they were legitimate, you reason, they would be marked. You may not even notice them if they come from side streets for which you have no stop sign or traffic signal. They only appear relevant when there is a person surprising you in the road. Hence you will be aggressive to pedestrians trying to cross at unmarked crosswalks, as you will (wrongly) believe you have the right-of-way. Pedestrians will, in turn, be intimidated as suggested by the Brookline document above. The empirical findings are sound as far as they go. I disagree with the recommendations. The problem is *inconsistent ambiguity*. There are two ways to resolve this inconsistency.

Solution A. Mark all crosswalks.

If we were completely consistent about where pedestrians might be found, (i.e. crosswalks) marking all crosswalks would be acceptable, drivers and pedestrians would both understand the law. It would be clearly spelled out to drivers where pedestrians might be, including smaller intersections that might otherwise be raced by. It would be bad from a pedestrian rights perspective, as it over-channelizes walkers and gives too much power to cars.

By implication, it requires pedestrians to use only marked crosswalks. It in a sense delegitimizes jaywalking (crossing the street midblock, which is in fact legal on many not-fully-signalized roads). It increases pedestrian travel times. As Peter Norton notes in *Fighting Traffic*: [15]

> 'Before the American city could be physically reconstructed to accommodate automobiles, its streets had to be socially reconstructed as places where cars belong.' ... 'Until then, streets were regarded as public spaces.'

[15] (Norton, 2011).

Figure 15.14: Crosswalk meanings vary globally. In Wuhan, China every traffic signal and most unsignalized intersections have zebra (striped) markings.

Figure 15.15: In Sydney, Australia, where paint is much dearer, every traffic signal has marked crossings. These crossings are not high-visibility like zebra crossings. Unsignalized intersections don't generally have marked crossings, with exceptions, like this bike lane. Vehicles in Australia will yield to pedestrians at marked crossings, not at unmarked crossings.

In practice, we will not mark all crosswalks. The vast majority of intersections in the US are unmarked, and no one wants to spend the money to mark them all. Hence if we claim to adopt solution A, we will in fact resign ourselves to *inconsistent ambiguity* (false certainty) for crosswalk markings.

Solution B. Unmark all crosswalks.

In contrast, if we were completely (i.e. consistently) ambiguous about where pedestrians would be, that would be good from both a safety perspective, and in the long run, a pedestrian rights perspective. While in the mixed environment, a pedestrian might wait more, in the no crosswalks environment, pedestrians will be cautious where they are now reckless. But pedestrians would also be more assertive in more places (those without crosswalks now) as they would know that drivers would also be more cautious. This strategy will make both drivers and pedestrians more aware of their surroundings since pedestrians might be anywhere. (See Chapter 16.)

In addition to unmarking all crosswalks, forgetful drivers seem to require periodic reminder signs/messages to drivers when entering new districts, leaving freeways, etc. that pedestrians have the right-of-way. Markers where pedestrians have died might somber-up drivers, just as ghost bikes indicate the location of bike fatalities.

It is the false expectation of consistency that causes many of the over 4,000 pedestrian deaths per year in the United States.

Note: This discussion applies to the United States, traffic laws, norms, and customs, as well as infrastructure vary elsewhere. In Australia, as shown in Figure 15.15, cars will generally stop for pedestrians at marked crosswalks at unsignalized intersections; while at signalized intersections, pedestrians should only cross at marked crosswalks if they value their life (not all legs are marked, especially at T-intersections). Notably many unsignalized crossings remain unmarked. But this at least tends to be standardized at the level of the state rather than the municipality. Crosswalk markings also have different meanings in China, as shown in Figure 15.14

16
Shared Space

Figure 16.1: Exhibition Road following opening of shared space scheme during 2012. Photo: Exhibition Road, London, via Wikipedia.

Originally published as Levinson, D. (2006-11-21) Transport without control and Levinson, D. (2010-08-12) Life without traffic lights.

[1] Quoted in (Vanderbilt, 2008).

'When you treat people like idiots, they'll behave like idiots.' – Hans Monderman, proponent of shared spaces.[1]

The idea of 'shared space' is straight-forward if controversial. Eliminating signs forces drivers to be more careful, and therefore safer (they are less likely to hit someone). It also makes them slower, and therefore safer (they do less damage once they hit someone). Monderman was critiquing the notion of traffic control devices (signs, signals, markings) that are everywhere around us when we travel. Travelers pay attention to the light rather than the other travelers, turning into 'idiots.'

However, one needs to think about what problems traffic controls

solved in the first place. Why were they invented and deployed? A congested intersection without control, or with stop sign control, moves many fewer motor vehicles per hour than one with traffic lights. If your objective is moving motor vehicles, this is an important consideration. That should not be your objective.[2]

[2] As the song goes 'Signs, signs, everywhere signs.' Five Man Electrical Band (1971) 'Signs'.

While peer-reviewed evaluations of shared spaces have been limited, researchers from Imperial College, evaluating nearby Exhibition Road, (Figure 16.1) find them to be effective (Kaparias et al., 2012; Karndacharuk et al., 2014).

Shared space isn't truly a 'spontaneous order' in that there are legal rules and social norms for behaving in the absence of functioning road control, but it does point out that in at least selected cases those rules, perhaps aided with a roundabout, applied by thinking individuals function better than centrally planned traffic signals that aim to circumvent individual decision-making.

The key is context. What works in one place may not work elsewhere. What would work if it were universal might not as an exception, or vice versa.

It often comes down to the original design and the current land use. When the intersection and adjacent land uses emerged prior to traffic signals, the intersection may work better without control.

If the road and intersection were designed in the modern era (e.g. a suburban arterial), it is more likely to require signal control, since that was implicit in its initial configuration. An intersection with three left-turn lanes implies traffic signal control, and retrofit is likely to be a kludge, though to be fair to shared space, no one has tried it in such a context.

Shared space more clearly works well where traffic signals work poorly, on an organic road configuration (as in many European and some East Coast US towns). Thus the effectiveness of traffic signals and shared spaces are historically contingent on the original design.

17
Winter is Coming

Figure 17.1: Backups in Atlanta due to ice storm. Photo by Doug Simonton, via CNN.

Originally published as Levinson, David (2014-01-30) Atlanta's Total Lack of Preparedness. (published on the http://cnn.com website; Levinson, David (2013-02-13) Walkable ice; Levinson, David (2013-03-15) How shoveling and plowing snow now extends the duration of icy sidewalks.

PREPARE FOR ALL SEASONS. Designs for access almost always make the assumption that travel occurs in good weather. Unfortunately, weather is not always good. There are any number of weather events, ranging from sprinkles on a dry oil-embedded pavement making it slick, to blizzard conditions making roads temporarily impassible and travel temporarily impossible. The following sections discuss some of the issues associated with designs and winter. This is far from comprehensive, but it should inspire thoughts on the topic.

17.1 *Atlanta's total lack of preparedness*

It's just water.

Of course it is frozen in the form of ice. Driving on ice is a fool's errand. On ice, it is hard to stop (or start) moving. On ice, vehicle control is difficult at best. You don't need to be a transport engineer to know that crashes increase with snow and especially ice, with its reduced friction. The problem is not that Atlanta got snow, but that the snow turned into ice.

Should Atlanta have been better prepared? In retrospect, the answer is obvious. In prospect it should have been as well.

While it's hot in the summer, Atlanta is in the foothills of the Appalachians, not the beaches of the Caribbean. In the past eight decades, it has snowed 4 inches or more 11 times in Atlanta. There are periodic ice storms. According to Weatherspark, the average low temperature in January is 34 degrees F, just above freezing. In other words, half the days in January the daily low is below 34.

I lived in Atlanta for five years. As a freshman, I remember a cold spell in January 1985, when Ronald Reagan's second inauguration was canceled in Washington because of cold, and Georgia Tech, where I was a student, had a delayed opening because it was 8 degrees. So winter is something that leaders should be aware of in Georgia.

Atlanta does not get as much snow as Minneapolis, my current home, and where we have stared down a polar vortex, and are at the time of this writing blanketed with about 2 feet (0.6 m) of snow. Atlanta is certainly not as cold as Minneapolis, where unusually, school was canceled two days this week, and five days this school year, and we now look at ice planet Hoth (where Luke Skywalker and friends were based at the opening of *The Empire Strikes Back*) as an improvement. But Atlanta still experiences winter. Atlanta still has access to forecasts from the National Weather Service. This storm was not a surprise.

There are several strategies for dealing with ice storms.

The city and state could have tried to mitigate the ice. There are many techniques for salting and sanding roads that either prevent ice from forming, melt the ice or make it easier to travel on ice. This requires a fleet of vehicles and drivers that are prepared well before the weather event and that continue to be deployed until the roads are cleared.

The risk is the city and state spend money on preparations for bad weather that does not come. Such spending is standard operating procedure in northern cities such as Minneapolis, where snow and

ice are almost guaranteed, but it may not be worthwhile if the ice were infrequent.

Atlanta could have tried to avoid the ice. If officials knew ice were coming (and they should have, the weather forecasts were not highly guarded state secrets), they should have canceled schools and encouraged people to stay home. The risk is you cancel school and it only rains, or the storm changes course. Officials who cancel school, only to see the weather improve, look bad, are considered 'fraidy-cats,' will be mocked by talking heads and Monday morning quarterbacks, and more importantly will have a harder time making the right decision the next time.

A real leader is not so insecure. New York Mayor Michael Bloomberg warned his city about Hurricane Sandy despite perhaps being (in retrospect) too conservative in his warnings about Hurricane Irene.

In the end, we should ask: Is missing a day of school, or working from home instead of the office really the end of the world?

Instead what officials in Georgia did was accept the damage (in the form of traffic congestion, crashes, people sleeping in place in their cars and schools instead of at home) caused by the ice. This outcome required no advance preparation or forethought. In fact a debacle of this magnitude required a careful absence of preparation.

Worse, everything shut down at once. Dismissals were not coordinated, exacerbating congestion. In the end though, the main problem was not that everyone left work and school at the same time. The problem was they were all there in the first place. In the long term, the Atlanta area could do much more to avoid its routine congestion. But in the short term, if you cannot prevent the special congestion caused by the weather, avoid it.

Is weather getting weirder? I don't know.

Is weather getting more predictable? Most definitely. The science is improving, and the measurements are getting more precise, and there are many more of them, all of which make short-range forecasts very accurate. Our politicians should listen to the scientists sometimes.

17.2 *On the storage of snow*

Figure 17.2: A 'cul-de-snow' created by snow plows clearing the street obscuring the cleared path on the sidewalk. Minneapolis. Photo by author.

As I write this, Minnesota is getting still more ice/sleet/freezing rain/snow today. We will see piles of snow for a long time. Why will we see piles of snow? Because we piled it up. The snow on top acts as insulation for the snow below.

Imagine there is a winter where we get 1 meter of snow (in fact the average for Minneapolis is 1.26 m of snowfall). On the 1 m wide boulevard between the 1 m wide sidewalk and the street, we get 1.5 meters high of snow, as we transport half the snow from the sidewalk to the boulevard to 'clear the sidewalk' (the other half goes into the

yard maybe, if we have yards. If we have buildings, it all goes to the boulevard). (I realize this is not all at one time, which complicates the model but does not change the basic point).

If the snow melts and sublimates at 5 cm/day (this varies), (and water (liquid snow) refreezes at night), instead of 20 mornings of icy sidewalks, we have 40 hazardous mornings. We have approximately doubled the problem.

This problem in embiggened when you add the snow plows piling additional snow onto the boulevard. In this case we take a 10 m wide street and pile 5 m x 1 m of snow on the boulevard on each side. Now we have put not just 0.5 m from the sidewalk but an additional 5 m of snow on each Boulevard. So the Boulevard is responsible for storing 5.5 m of snowfall over the course of the winter. The ground absorbs very little since it is frozen.

Fortunately, cars are local urban heat islands, so the road is warmer than the sidewalk, and the snow melts back towards the roads at a faster rate than on the sidewalk. Unfortunately, sidewalks are interrupted by streets, which are now icy and slushy in the gutter in the morning. Similarly, we are fortunate that buildings are urban heat islands. Unfortunately, new buildings are well-insulated, greedily keeping their warmth rather than sharing it with the adjacent sidewalks.

For the purposes of walking, we should consider whether it might be better to not shovel or plow at all, and take the inconvenience of walking (driving) through snow, than to shovel and increase the duration over which we must traverse ice and slush. This might be a case of getting punished for doing the 'right thing.'

An alternative is to actually move the snow off the sidewalk's upstream water-basin. In large cities, we might take the snow piles and put them to the side away from the walk path. This answers the question: Surface parking lots, what are they good for?

17.3 *Walking on snow and ice*

Figure 17.3: Packed ice in Minneapolis. Photo by author.

For many years I lived in Minnesota. It was lovely from late May through October. Like much of northern North America, winter graced the rest of the year. This too was lovely, unless you had to walk in it. Snow itself is not so bad, it gives traction. While with significant snow more work is required to lift your legs, you are not really in much danger of slipping. Ice on the other hand is a disaster. Treating it is not a simple thing. Not treating it results in falls and injury, which clearly is detrimental to the quality of the walking environment. Given the strong social desirability of having more people walking rather than using motorized travel, this is unfortunate.

My own house suffered this problem, despite (or because of) snow clearance, ice re-forms on the sidewalks and steps, or freezing rain falls on the cleared sidewalks, making them slick, rather than on snow-covered sidewalks, making them crunchy. Further, water drips from the house and gutters because of ice dams, and then freezes on the ground.

My alma mater, Georgia Tech, in the warmer environs of Atlanta, was not typically subject to much snow or ice. Even so, it had many sidewalks just above steam-heat pipes, which would clear those sidewalks pretty readily in most conditions. The University of Minnesota, where I worked, does a pretty good job with snow

clearance, all things considered, using a lot of labor and snow clearance machines in the process.

Ice clearance is hard in this freeze-melt cycle, especially when the water has no where to drain because:

1. Sidewalks are convex (along either width or length) so water melts but has no where to run off to,
2. Boulevards[1], where street trees might grow. are covered in snow creating no place for run off and creating a source for new melted and soon to be refrozen water,
3. Storm drains are covered in snow, and
4. Ground is still frozen and/or the soil above the freeze line is super-saturated.

[1] 'Boulevard' is a Midwestern term for the strip of grass between the street and the sidewalk.

I see a lot of attention to ice-free roads, and very little for ice-free sidewalks. This would greatly enhance walkability, reduce the likelihood of severe injury, and increase the number of pedestrians.

There are a variety of ways to address icy sidewalks:

- Mechanical: clearing sidewalks with shovels and pick-axes and snow-bots.
- Friction: Sand, Grit, Gravel make the ice more walkable (by increasing friction);
- Chemical: Salt (reduces ice via melting);
- Radiant: heated sidewalks (using a variety of techniques);
- Protection: covered sidewalks; and

If we consider the cost of an icy sidewalk equal to the probability of a fall multiplied by the cost of a fall, multiplied by the number of people who face that probability per day, times the number of days the sidewalk is icy, we can get a sense of the amount we should invest to avoid the ice.

It turns out that under some assumptions, about 160 pedestrians per day would be a break-even point for heated sidewalks (See Section 17.4.)

There are things we can do to better accommodate the ice as well.

- We can wear cleats of some kind or another. The problem is walking on non-ice, or worse cleared pavement, is not nearly so good with this tool. And ice is non-homogenously distributed across our sidewalks this time of year.
- We can walk around with hair dryers and very large batteries.

- We can drive.
- We can not travel on ice.

I like the last one best. Why are we walking around on ice? In the end, not all travel can be safely accommodated.

POLICY RECOMMENDATION: Use student labor to clear sidewalks with low pedestrian flows. Heat sidewalks which have high pedestrian flows. Cover sidewalks with very high pedestrian flows. Avoid pedestrian flows on icy sidewalks.

AUTHOR'S NOTE: Yes, I did fall this year. This section was written between my vertical and horizontal positions, so I apologize in advance for its rushed nature.

17.4 *Appendix: The cost of preventing ice*

Let's say I fall once a year on the ice (typical), after traveling 2.6 km * 2 times a day * 10 ice days = 52 km. My fall rate is 1 fall per 52 km of ice.

For a house with 10 m of frontage, with 100 pedestrians a day, it gets 1 km of pedestrian traffic per day. Once every 52 icy days, it will see someone fall.

The cost of a fall is unclear, since most falls are unreported. For reported falls which require medical care, the estimate is on the order of $10,000. Let's assume 10% of falls require medical attention, meaning the average cost per fall is $1,000.

This implies that every 52 icy days (once every 5.2 years if there are 10 icy days per year), each house with icy sidewalks imposes $1,000 in costs. In that case, if we want to minimize social costs, we should be willing to invest $19/day in effective ice clearance. This is about an hour of labor (or two hours of undergraduate labor) to operate simple machines plus some cheap (Friction or Chemical based) treatments). Unfortunately, I am unclear whether $19/day is effective.

We could add delay costs, due to people walking slower on ice, which I estimate to be about a 10% reduction in walking speed. With a travel speed typically of 1.44 m/s, we might decrease that to 1.3 m/s. So instead of the 100 pedestrians taking 7 seconds each to walk in front of the house, they are taking 7.7 seconds. That is 70 person-seconds per day, which has an economic value of (at $15/hour) of $0.30 per day, two orders of magnitude lower than the fall costs, and so not really worth discussing further.

But can we prevent the ice from forming?

For $1000 every 5.2 years, we get $5000 for a 26 year expected life of a capital investment. If we can make a capital investment of less than $5000 to eliminate falls on our public sidewalk, it would be socially worthwhile.

The cost of heating sidewalks is about $20 per square foot (or about $215 per square meter). A 10 meter by 2 meter sidewalk is 20 meters square, giving us a cost of $4305.

Operating costs are estimated at $0.60/h. If it is operating 240 hours per year (this is a guess, I don't know how long it needs to operate to keep the sidewalk ice free), this is $144/year. (You might run it to melt snow, but that has fewer benefits, just avoiding shoveling, not reduced falling in this simple model, so I don't consider that). $144/year is $3744 over 26 years (no discounting), so is a large fraction of the capital costs.

Unfortunately, \$4305+\$3744 > \$5000, so 100 pedestrians is not enough to justify heating. However 160 pedestrians would be a break-even point.

Heating a sidewalk section has climate change implications with the current sources of non-renewable energy. Brendon Slotterback, a sustainability planner reports that:

> "the 26-year cost of this section at \$8,722 at the low end and \$9,708 at the high end (depending on the discount rate you assign to the future impacts of climate change. I tend to lean towards the higher end). This means your break-even point is 8% to 20% higher, meaning maybe 173 to 192 pedestrians per day. Of course with a carbon tax in place, there would likely be more walkers in some places, meaning heating the sidewalks become feasible in more places.
>
> Now, if you could use waste heat that hasn't been previously captured to heat sidewalks, as they are proposing to do with the new 'interchange' plaza and HERC steam [HERC is the Hennepin Energy Recovery Center , a waste to energy incinerator], the carbon footprint becomes effectively zero additional. Much less per kWh/BTU.
>
> Other interesting facts, heating all the sidewalks in Minneapolis with electricity from the grid for one year would produce more greenhouse gases than the disposal of all our solid waste and wastewater does over the same time period. The additional energy consumption would be equal to about 1/3 of the current annual consumption in all residential properties in the city. It would increase the city's annual electricity consumption by 8%."

He nicely identifies a feedback effect, heating up sidewalks will create more emissions, which will heat the atmosphere, which will eventually negate the need for heating up sidewalks. There must be an equilibrium point here.

The use of waste heat is a great idea, especially near the HERC. The problem would be building infrastructure to distribute that more broadly. There might also be waste heat from wastewater (which is still liquid in the winter, and thus warmer than the ground around it) which we don't capture, or let go to roads, by running sewers under the streets rather than the sidewalks.

Covering the sidewalks (200m of roofing) could cost \$80/square foot (\$860/square meter). This lasts 15 years. For 20 square meters, this costs \$17,200, well out of range for our residential sidewalk if the only objective is ice reduction, especially since it only lasts 15 years. It might have other benefits, such as reducing our exposure to nature and street-life though.

18
Diversity as Insurance

Figure 18.1: Convergence of modes in Tokyo. Photo by author.

Originally published as Levinson, David (2016-01-29) Transportation Diversity as Insurance on the *Strong Towns* blog.

Diversity insures against risks. Diversification of investments is often suggested in personal finance. The claim is diversification reduces your potential downside loss. (Logically, it also reduces your upside gain.) The appropriate degree of diversification depends on your tolerance for risk.

More generally, there is a cost to insurance. It may turn out the risks you were insuring for did not happen. You might buy fire insurance, and never face a fire. In that event, the insurance premiums were money you could have spent elsewhere. For others - who lose homes, they get back more than they put in. On average, with a mutual insurance system, there is a slight loss due to

administrative overhead, but the cost is worth the benefit if the large losses due to a fire, multiplied by their probability, are worse than the small but certain losses of the insurance premium. The probabilities of various events are well understood by insurers, and large risks are pooled, and then pooled again in a re-insurance market.

In transport, we often talk about resilience. From a resilience perspective, diversity is a good thing. If one kind of thing fails, perhaps the other kinds of things will not. Path diversity on networks has recognized and measurable value. If one link fails, say due to a bridge collapse, a sinkhole, or a major crash, and is closed, others can pick up the burden. There may be stresses on the system which show up as congestion, but at least connectivity can be maintained.

Modal, energy, or technological diversity could be useful. If the bus system's drivers go out on strike, people could walk. If gasoline becomes expensive, people could take a bus or train, or switch to corn ethanol, or electric cars.[1] If all cars were recalled because people are suddenly horrified they kill 35000 people a year, travelers can ride a bike. Again, this is limited by the amount of available capacity in the alternatives, and in practice most people cannot take the train in the US, at least not tomorrow, but it provides some type of technological redundancy where it is an option.

[1] (Bronson and Marshall, 2014).

So the question in transport is whether existing or additional network and modal insurance policies are worthwhile. We will never know for sure until after the fact. Yet it is not hard to imagine the kinds of risks that occur. We see link failures regularly, so know that path diversity is good. We see that link failures are worse on more fragile systems like limited access freeways and subways, and so the penalty we pay for faster average speed is lower reliability. We have seen technology failures, from the (policy-imposed) 'oil shortages' of the 1970s and price shocks of the 2000s, to transit strikes, to vehicle recalls. One could imagine that Lithium, for example, will be the new scarce element in a world of battery-electric vehicles. If not that, something else. Scarcity is not eliminated just because oil is replaced.

All of which is to say don't put all your eggs in one basket. We need different types of redundancy, choices in transport modes, paths, and energy sources, multiple possible destinations that serve similar types of purposes, the ability to do things in person or remotely. The more alternatives we have, the less vulnerable we are to any particular type of failure. But we also cannot economically justify empty buses or empty roads because something might

happen.

Slowly, the surface transport sector is re-recognizing the advantages of connected streets networks, certainly for pedestrians and bicycles, but also for motorized vehicles. The advantages of multiple technologies are less clear. In the extreme, school buses can be used for evacuation, pools of buses can be moved from one city to another in the emergency (unless you left them to flood like New Jersey after Sandy), and so on.[2]

[2] Unfortunately train cars are not as compatible between cities as they should be.

We are slowly realizing that the empty seats in a car on most trips are redundancy that can be exploited, with services like UberPool and LyftLine.

These are types of conversations that are seldom heard in surface transport, but are common in aviation. When a flight is cancelled, an airline tries to route its passengers. It has a redundant network. The alternative paths (flights) are seldom as convenient, and may require a transfer – or worse for the airline – booking on a competitor, and will take longer, and passengers will grumble, but eventually the passenger gets to her destination. The airline will not generally rebook you on a bus or train (though I have been bused to a final destination when an airport was closed due to fog).

We have a lot of resilience now. There are low cost solutions to get more. Think about investments that are flexible and adaptable, rather than brittle, and solutions that work under a range of conditions, not just a single set of assumptions. By systematically planning the network to reduce the likelihood and consequences of failures, people's freedom to act in the future in less constrained.

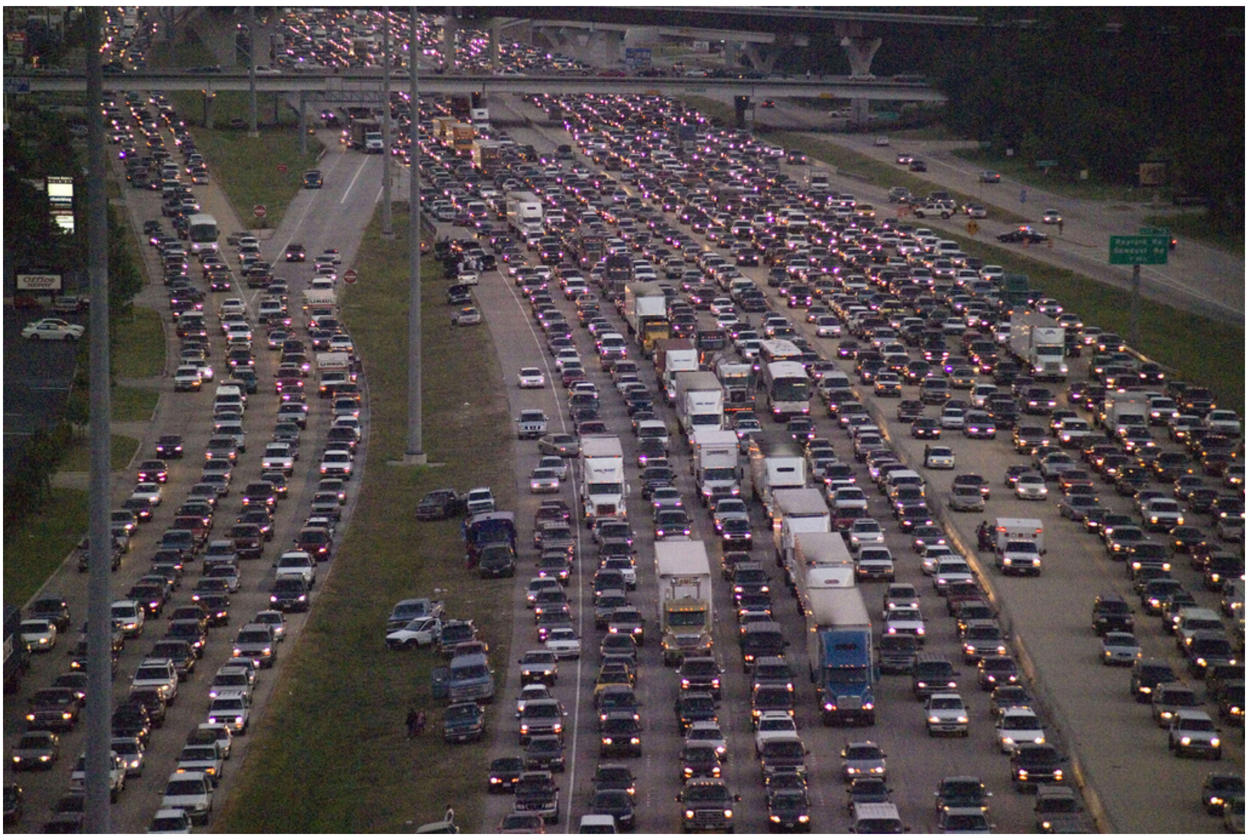


Figure 18.2: The evacuation of Houston before 2005's Hurricane Rita went badly, and so no evacuation was undertaken with Hurricane Harvey (2017).

19
Differentiate City and Country

Figure 19.1: Drawing: Broadacre City by Frank Lloyd Wright.

Originally published as Levinson, David (2014-10-29) City vs. Country.

Differentiate city and country. One of the many dysfunctions in transport planning is our collective inability to recognize the difference between city and country.

It's really not that hard. In the country distances between buildings are large, while in the city they are short. In land use jargon, densities are lower in the country than the city. There is a continuum between country and city on the land use side; however transport modes are qualitatively different and discrete choices, and don't form a nice continuum.

The most useful form of transport varies between city and country.

In the country, individual, point-to-point, on-demand service (foot, horse, bike, car) saves a great deal of time over feasible

shared, scheduled, fixed-route services (transit). That time savings offsets the individual cost and social savings from sharing a vehicle with other passengers. This maximizes spontaneous access for rural residents.

Figure 19.2: Red Routemaster City Bus in London. Photo by author.

Figure 19.3: Green Routemaster London Country service buses used to serve suburban and rural areas. Photo via Wikimedia Commons.

In the city, shared transit services are on the whole less expensive to the user and society than individual services. The small increase in time is offset by cost savings from sharing. The greater density allows more frequent service and more direct service nearer the traveler's trip end points. This maximizes access and spontaneous action for urban dwellers.

In idealized low-density places like Frank Lloyd Wright's Broadacre City, shown in Figure 19.1, local transport was clearly individuated, to the point it appears everyone has a private gyrocopter. In Ebenezer Howard's Garden City, individual transport was used to get around town, and to access the inter-municipal railway. In Jane Jacobs' New York City, walking accesses transit for longer distance urban and inter-urban travel, while the car was not especially welcome.

From both a transport and land use perspective, each of these works on its own terms (assuming gyrocopters actually work).

In short, in the current technological environment, there are two stable points: one where a sufficient number of people have abandoned their personal cars and use transit daily that transit is sustainable with high frequency and ubiquity; and one where people keep their cars and use transit on special occasions (for instance, to go downtown or to the State Fair for entertainment).[1]

Once the car is owned, the marginal cost of the additional trip to most destinations is sufficiently low it outweighs the combination of low costs of shared transit vehicles with higher travel times.[2]

A metropolitan area is large enough to contain multitudes. There can be a center where people live car-free because the transit (or walking or biking) is good enough for daily city-based work and non-work trips, a ring where multi-person households have one car-only and some household members use transit for daily trips, and a countrified-edge where people live transit-free, since living and working in the suburbs is seldom a market transit can well serve (except as an accidental spillover where people are lucky or skilled enough to have home and work aligned on the same radial transit line).

[1] (Bar-Yosef et al., 2013).

[2] This is because free parking is found for something like 99% of all destinations in the US, gas prices and taxes are low, and we don't have road pricing.

20

Don't Confuse the Place for the Time

Figure 20.1: Hampstead Garden Suburb. Photo by author.

Originally published as Levinson, David (2013-09-09) It's not the suburbs, it's mid-late 20th century urban design.

Don't confuse the place for the time. If the city is the *thesis*, and country is the *antithesis*, suburbs are the *synthesis* – the place where most Americans reside. American urbanists like to criticize 'the suburbs,' but this isn't really fair. The suburbs are just a place, like South Dakota, or Australia, or Antarctica. They cannot change where they are.

Some of this is a criticism of 'suburbanites.' But so long as there is housing in the suburbs, and transport to enable people to move, someone will live in the suburbs, at a higher or lower rent depending on relative market preferences for space or travel time.

Some of this is a criticism of suburban politics. But this comes

with self-selection, people want to live with people with similar preferences. The alternative is those with different political, religious, and athletic views live together, which would inevitably create more conflict.

Some of this is a criticism of suburban travel behavior. But this is really due to suburban land uses and network patterns, discussed below, and demographics and socioeconomics which cannot be changed easily.

Some of this is associated with land densities. Much of this is unfair as every place starts undeveloped and adds development over time, some places are more complete than others. Some of this complaint is legitimate in that particular subdivisions make intensification of development technically difficult and probably illegal under current zoning. But population densities dropped in most American central cities from their 1950 peak, both due to a hollowing out of individual houses as average household size dropped, and demolition of housing and replacement with lower density developments including more surface parking.

Some of this is a criticism of suburban street patterns. But this is not inherently associated with the suburbs, it is really associated with an era. Streets that were built in certain periods had particular spacings, connectivity, widths, curvatures and so on. You can even see it in some urban brownfields that were redeveloped in this era.

Consider older towns, for instance county seats of suburban counties. While in the 19th century, they often had road, river, and rail connections with large cities, they were not in the daily metropolitan system, as people did not commute back and forth so regularly. Certainly residents of these places were affected by the nearby big city, but they were not, at the time, suburbs. These towns mostly have design coherence.

Similarly look at areas that we call suburban developed before World War II, particularly first ring suburbs. These too often have design coherence. Figure 20.1 shows an early Garden Suburb in London. If suburbs were more like this, I suspect the complaint level would decrease.

The problem with the suburbs isn't that they are not the city. The problem with the suburbs is the same problem as the city, *they had a bad 5 or 6 decades of urban design*. Cities in the same period saw urban renewal, mostly mediocre architecture, replacement of buildings with surface parking lots, and a general hollowing out. It's not because it's the city that this is a problem, it's because there were some terrible design (planning, engineering) memes out there which got implemented as policy, while operating in a market that

(a) Glebe, NSW - late 1800s (b) Marrickville, NSW - early 1900s, (c) Rouse Hill, NSW - late 1900s

Figure 20.2: Australian suburbs of different eras exhibit different residential and automotive densities. Photos by author.

just had no taste. It is worse with the suburbs, as for many, those six decades of urban design were the only six decades of development they had, while for the city, at least the older street network remained mostly intact, as did some of the older commercial buildings and much of the housing stock.

It's not the now-assimilated suburbs built before the big cities reached out to envelop them within the daily metropolitan system. It's not the older suburbs within the core cities, or the first ring suburbs adhering to the grid. It is a particular design of a particular era which enlarges distances between places in order to offer larger parcels of land on which to spend time and store cars.

To reverse this trend of larger and larger homes on larger and larger lots farther and farther from each other, people will need to want to spend more time off their property, bear more affinity for their neighbors, and promote changes to land use rules. Technologies, policies, land uses, and transport networks which reduce the demand for car ownership and car storage will facilitate this.

Many core cities are slowly gaining population, and perhaps population share, car ownership is down from its per capita peak, and car and bike sharing is up, new housing is being constructed in urban areas, and it seems if development is growing up faster than out. In short, the trends are favorable for more urbane suburbs. These trends just have to run for five decades to undo the problems remaining.

Figure 20.3: In many Chinese cities, as shown in this model of Shanghai, the suburbs and the city are indistinguishable by local population density. Photo by author.

21

Great Britain doesn't have an Americans with Disabilities Act

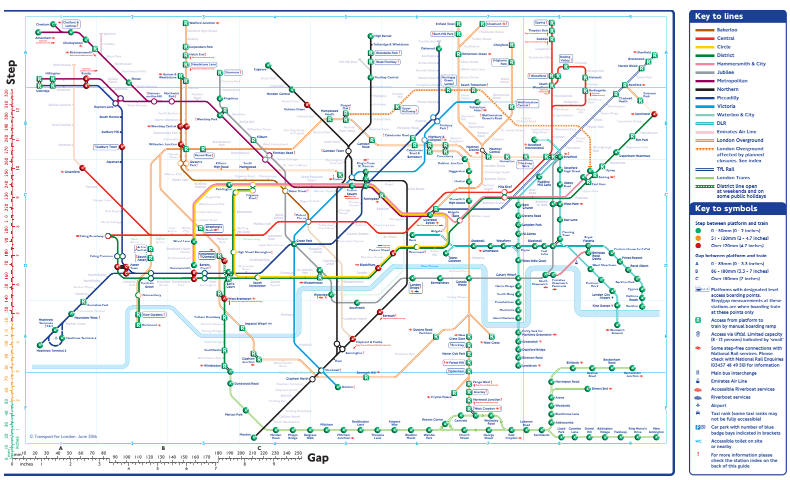


Figure 21.1: The reduced network for those with disabilities can be seen in this map, the faded lines and stations are not accessible step-free. Source: (Transport for London, 2017)

Originally published as Levinson, David (2007-01-30) Britain doesn't have an Americans with Disabilities Act.

Functionality for the disabled is functionality for all. Great Britain doesn't have an *Americans with Disabilities Act*. Now, you may say, why would Britain care about 'Americans' with Disabilities? What I mean by this are that conditions for those with disabilities in Britain seem much harsher than in the US. In particular, I will note the public transport system, especially the rail system.

To be clear, Britain does have a *Disability Discrimination Act of 1995*.

It is just that the requirements that are made of extant systems are much more modest than the US.

The reason I note this is not, fortunately, because anyone in my household is physically disabled, rather because, while living in London as I and my wife often took our then 2-year old son and later his newborn sister out in a stroller, we noticed problems that just don't appear to us in the US. In part this is because we don't use public transport nearly as much in the US, and when we do it is in the more modern Twin Cities Metro, San Francisco BART, and DC Metro systems. In those systems there would be an elevator to get to the platform at every station that needed one. (In DC, nevertheless one often sees out-of-order signs on its elevators.) In London, even where it would not be difficult to provide a ramp, a short staircase is often the only alternative. Sometimes, a long staircase is required, leading to the stroller carry (which is easier than unbuckling, lifting, carrying, and rebuckling a sleeping child).

A quick review of the TfL Underground map shown in Figure 21.1 illustrates the extent of the problem, long segments of entire lines, especially the older ones, and many stations just are not part of the effective network.

One could argue this is about economic efficiency. Retrofitting hundreds of stations would be expensive. But the relevant value here is not efficiency but equity and inclusion, if economic efficiency were the criteria, one would make almost no accommodations for the disabled. Without accommodations, the disabled have a reduced network, and thus less accessibility.

This is one more case where the buses beat the trains. Buses are a short enough step that manipulating a stroller is not too difficult. They also have better accommodation for wheelchairs than trains, though in our first four months in London, I only saw one wheelchair on a bus.

Most of the sidewalks do have curb cuts, though the rough surfaces make wheeling along them less than optimal, but not impossible.

'Barely hospitable' is the phrase my wife uses to describe London's infrastructure. Many Underground patrons are quite helpful in lifting one end of the stroller while one of us has the other, it is the infrastructure that is not designed for anyone who is not fully mobile.

22

Designs Serve Varied Interests

Figure 22.1: Adapted from Poster from Münster's Transport Department, c. 1980: space required to transport 60 people by car, bus, and bicycle.

ACKNOWLEDGE AND RESPECT MANY STAKEHOLDERS. Ask 'For whom is the design?'

RESPECT YOUR CLIENT. The most obvious stakeholder is the client, whoever pays your bill. You might think this is the bureaucrat at the public agency who approves your invoices or signs your paycheck. She is but one of many.

RESPECT AND TRY TO PROTECT THE ENVIRONMENT. Transport projects move dirt and injure the environment. This is the natural order of construction. One can try to minimize the impact of the construction, and to remediate the damages after the fact, or restore some other place in penance as compensation for the destruction you have done, or even pay indulgences to another organization to get into environmental heaven, or at least out of purgatory, but inevitably something is disrupted when humans touch nature. That said, it is better for the environment in general if humans have a

smaller footprint, i.e. they live in cities rather than spread across the landscape, if they use less space while moving, and if they travel shorter distances.

Selected dimensions on which travelers differentiate

- Work status
- Age
- Experience
- Race and ethnicity
- Ability
- Phobias
- Immigration status
- Education
- Bicycle ownership
- Language skill
- Cognizance
- Biking skill
- Sex
- Wealth
- Auto ownership
- Household structure
- Information status
- Driving skill

RESPECT SOCIETY. Society as a whole benefits (and bears costs) from the design. Why should they support (or oppose) the proposal? Be clear in your mind and in the presentation of your proposal what the actual full benefits and full costs are of whatever you propose to do. There are always winners and losers. The gains should outweigh the losses. To improve equity, the benefits should be used to compensate the losers, either as part of a bundle of projects or as a side payment. You need social consent to accomplish anything in the transport realm.

RESPECT NEIGHBORS. Neighbors live next to your project. They might very well be non-users of the project. Think about someone living adjacent to a highway, without access, or next to the rail line without a station. Neighbors bear many of the external the costs of infrastructure and may not receive any benefits, especially if the accessibility bypasses them. Projects acquire land from neighbors. Their political voice can stop what the transport builder might view as progress, as they are the most vested in opposition.

RESPECT TRAVELERS. Travelers are the users of the system. They come in many shapes and sizes, each wants different things. The mental model of most designers is themselves. Most users of most designs are not like themselves across many dimensions. If you are a working, white, non-Hispanic, English speaking male, with three children, age 49, without visible physical or mental disability, with a secure retirement, with a graduate degree, who works in the transport sector, has mental maps of the network in a city they have lived in for more than a decade, have a drivers license and a car, you might just have different needs and wants from the system from someone who isn't any or all of those things (and vice versa). While everyone may want to engage in spontaneous action, the actions of interest are very different. Think of your proposed design in terms of different prospective users. Even better, find reviewers who are different than you, they will bring perspectives you cannot imagine. Just for starters, the list in the margin shows 18 dimensions to consider

23
A Vision of Visions

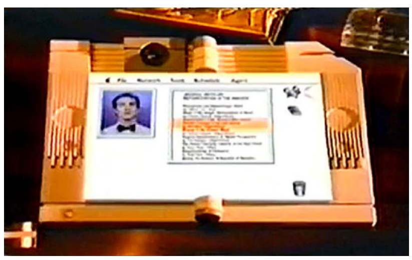


Figure 23.1: Photo: Apple Knowledge Navigator video screenshot. (Dubberly, 2007)

Originally published as Levinson, David (2011-04-30) 'Is Vision Necessary?

We require visions, but should not fixate on any particular vision. Planners, Thomas Campanella writes, following the legacy of Jane Jacobs, have abandoned vision.[1]

[1] (Campanella, 2011).

What passes for vision follows the formula for concept videos, like John Sculley's famous 1987 *Knowledge Navigator* (Figure 23.1) featuring a middle aged nebbishy professor being guided by a bow-tied Siri-like actor.[2]

[2] (Dubberly, 2007).

Seeing little satisfaction from the community they are hired to serve, planners tend to abdicate their role as visionary, and instead choose to be *consensus-builders*.

The loss of inspirational vision is palpable. Cities need both a galvanizing vision to shape direction and concrete incremental decisions to move in that direction. Whether a vision helps or hinders incrementalism depends on the vision and who it is pitched to. The classic argument of 'The Perfect being the enemy of the Good' often delays useful projects to the point nothing is accomplished.

When planning new products at Apple Computer, founder Steve Jobs, who recruited John Sculley, was fired by him, and later returned to the company he founded, clearly had an internal vision, but he did not want to reveal it before it was ready. He was dealing with private goods, and surprise and delight were key elements in the

vision itself. Public works on the other hand cannot really be sprung on the public anymore in western democracies. Hence plans.

We need some form of vision on which to base current decisions. But we need to continually re-evaluate those decisions, and that vision. We cannot get stuck on zombie plans, which are the all-too-frequent result of visions, but we also cannot act aimlessly. Everyone can agree that a good, inspiring, consensus vision that engenders people to strive for a better world is the best outcome. Is a bad vision, a misguided line on the map, or a poor investment strategy because the vision or plan became an implicit contract worse than no vision at all, where individuals stumble about and inadvertently but inevitably create their future?

Unlike vision videos, which if wrong or distracting can easily be discarded, the plan somehow becomes permanent.

24
A Faster Horse

Figure 24.1: Russian artists Komar and Melamid created artwork dubbed 'People's Choice' based on polling results.

Originally published as Levinson, David (2009-07-01) 'Urban Planning as Consensual Illusion' and Levinson, David (2010-10-26) 'Public Participation and Planning' Transportist.org.

PUBLIC PARTICIPATION DOES NOT REQUIRE PUBLIC DESIGN. As Steve Jobs has said:

> 'It's really hard to design products by focus groups. A lot of times, people don't know what they want until you show it to them.'[1]

A lot of times, people don't know what they want until you show it to them. There is a well-known expression that 'A camel is a horse designed by committee.' And while there is no evidence famed automaker Henry Ford actually said "If I had asked people what they wanted, they would have said faster horses," he probably thought it.[2]

The painting, 'People's Choice' at the beginning of the chapter (Figure 24.1) is the satirical product of artists who set about designing in response to customer's preferences in art. The survey suggested people like blue, traditional, realistic art of outdoor scenes including bodies of water in autumn. Similar paintings were constructed for multiple countries.

[1] BusinessWeek (1998-05-25) (Nine years before the iPhone and 12 years before the iPad). Quoted in: (Linzmayer, 2006).

[2] (Vlaskovits, 2011).

The painting of course is, at best, cromulent.

PLANNERS SHOULD RESPECT VARIOUS CONFLICTING INTERESTS. But planners have gone too far in asking for public input. The public does not have the time or expertise to productively weigh in on most issues, which is why the US has representative government, division of labor, and experts. (To be clear there is a risk that the wrong experts, often hired-gun consultants, from out-of-town, will give bad advice.)

The public that does weigh in is atypical, often retired, and inherently conservative in their tastes. Trying to adhere to the public's wishes results in mediocre designs coupled with an unwillingness to try new ideas that are unfamiliar.

In the Prospect Park neighborhood of Minneapolis, Hennepin County, the lead agency for an intersection redesign of a complex five-way signalized intersection, presented an alternative of a roundabout that was simultaneously opposed by the mostly elderly 'professional' citizens because it would be successful and move traffic too well and thereby attract more traffic (the residents thought they understood induced demand), or fail and result in too much delay. The public agency, wanting community consensus, went with the politically easy, instead of transport-system improving, approach. In the end, traffic signals were re-installed.

William Gibson's *Neuromancer* defined cyberspace as a 'consensual illusion' obtained when a user 'jacks into' the network.[3] Plans for cities are also consensual illusions, a community agreement how the city will look at some future date. Planners are but illusionists, confidence men (and women) channeling (but not really creating or shaping) a fantasy for how a city imagines itself, and through this consensus, harnessing the positive feedback processes of public and private investments aiming to achieve self-fulfilling prophesies. By promising networks, development will come; by promising demand, infrastructure will come. This consensual illusion is a vision, but not one to motivate.

[3] (Gibson, 2000).

25
The Ant and the Grasshopper

Figure 25.1: 'The Ant and the Grasshopper', from *Aesop's Fables* Source: Project Gutenberg. Illustrated by Milo Winter (1886-1956).

Originally published as Levinson, David (2015-06-09) Presents to our future selves and Levinson, David (2015-02-18) Speculative hypothesis: Planners' discount rates are too low.

Planners' discount rates are too low. When we are children, we learn the fable of the ant and the grasshopper. Briefly, the ant saves food for winter, the grasshopper doesn't, and instead goes clubbing. The ant survives, the grasshopper doesn't. Moral lesson: plan for the future, food isn't as plentiful in the winter.

And certainly we should all plan to some extent. Today the

personal economic issue is retirement, and many people don't save enough in the US to live as well as they might like upon ceasing full-time work. This is in part because they lived too well while they were working instead of deferring pleasure.

When I try to explain to people (usually my students) why they should get their stuff together, I argue that it is a present to your future self. For instance, who cares if 'bachelor you' makes your bed except 'bachelor you' in 16 hours, who might be slightly happier to come back to a made bed. The same is true not only of tidiness and cleanliness, by also things like data backups, organization, data and software documentation, saving and investing, insurance, and so on. You don't benefit now. (These things all take effort). No one else benefits now (except maybe the bank or insurance company, or the backup company). And in general, no one benefits in the future but you (though documentation may benefit the next person, it is usually just you in a year after you forgot what you did).

Similarly, cities can do things that are presents to their future selves. These benefit the city in the future, at the cost of something today. More formally, if the discounted future benefits outweigh the present costs, these are worth doing. This is what planning is for. Identifying things, which if done today, benefit tomorrow at a level greater than the cost.

From a functional planning perspective, these include things like building infrastructure. Infrastructure has a long life span. We have to spend money today, or decide to borrow money which we pay back, to get the infrastructure. Clearly some infrastructure is worthwhile, and some is not. Good planning, unlike macro-economics, differentiates between the worthwhile and worthless. Some examples:

1. PRESERVATION OF LAND FOR PARKS AND RIGHTS-OF-WAY. The things that make today's cities attractive and functional are presents bestowed on the city by forefathers who spent public resources to acquire land rather than let it be developed upon as in other cities.

2. OPEN DATA. Understanding the city requires data about the city. Making that data public helps researchers, but the greatest benefit comes in 10 years time, when trends can be studied, and policy outcomes ascertained. Without data, we cannot know what is good and what is not. With data we have hope.

3. EDUCATION. Schooling gives private benefit to those who are

schooled. We don't expect productivity out of 5 year olds, we barely expect it out of 25 year olds. So if you stay in town after you grow up, your education might produce some positive spillovers to the communities that invested in you, and collectively we will be glad we made the investment. If you leave for another city, your future productivity goes with you.

4. MUSEUMS AND LIBRARIES. Collections of artifacts are nice. Suppose we spend, say, $100 million opening up the *Metropolitan Museum Of Obscure Planning Documents*.[1] That only pays off if people can read those documents in 50 or 100 years. It isn't worth it just as transitory performance art.

[1] Chinese cities do have urban planning museums. Shanghai's is featured in Figure 20.3.

There are certainly plenty of things we do that are valuable today, for which the payoff is immediate or nearly so (like eating, or drinking, or watching the local football team lose). Tomorrow those will be forgotten. Ask instead what can we do now that will clearly benefit future us in 5, 10, 20, 50, or 100 years?

BUT THERE IS THE OPPOSITE VIEW, WHICH IS THAT OF 'LIVE FOR TODAY, FOR TOMORROW WE MAY ALL BE DEAD.' Saving for the future does you no good if you have no future. The earth might be destroyed by an asteroid (think about the poor dinosaurs who spent their lives saving instead of clubbing, where did that get them?). Or we might destroy ourselves (when I was a child, the boogey-man was Nuclear War, then Nuclear Winter, then Acid Rain, then the Ozone Hole, now Global Warming ... there is always a boogey-man). Or our society might be undermined by an outside threat, real or imagined: Osama bin Laden or Emmanuel Goldstein.

So how much to save depends on the likelihood of survival and persistence. If I expect to live, or at least be able to transfer my wealth to descendants, my motivation for savings is higher. If I expect to die, or have my assets seized, or depreciated in a major round of hyperinflation, really what is the point?

People engaged in the planning field have by their very nature a longer time-horizon than random. They are looking at public works that will take decades to get built (and years to build), and last many more decades if not centuries.

Forecasts predicting gloom and doom (the 'scare forecast') (too much congestion on a map painted red) far into the future are 'bringing distant dangers near.' We have no reason to plan for tomorrow's possible problems when we have plenty of problems staring us in the face

From a financial economic perspective, it is often unwise to make these long-term speculative investments, or even plan to make these investments, their payback period is too long, the technology may change in the interim. Resources could be better allocated to things which can be made, and innovated, in a much shorter time horizon. The modern version of capitalism ruthlessly (eventually) punishes these investments.

Though I don't think a formal study has been done, much of the private capital invested in transport infrastructure historically has been wiped out. There are many reasons for this, not all of which are market related, some due to regulation, which is why such investments have most recently been mostly left to the public sector. And recent examples of private infrastructure investment have been nothing to write home about: Dulles Greenway, Indiana Toll Road, the Channel Tunnel, the London Underground are just a few of the high profile disasters. At a minimum, getting this right is hard.

The discount rate is how we discount future money back to the present, it is the interest rate you earn on investments looked at from the other direction. Are you indifferent to $1.00 today or $1.10 a year from now. Then your discount rate is 10%. The planner's discount rate asymptotically approaches 0%.

Robin Hanson at the blog *Overcoming Bias* makes an interesting distinction between what he calls 'far' and 'near' modes of thinking (officially Construal Level Theory). (Hanson, 2010). We are more idealistic in 'far' mode. While almost everyone operates in both modes some of the time, some people operate in one mode more often.

Long Range Transport Planners in practice seldom lay out actual deployment paths, and instead focus on the end state, a vision, a 30-year plan. A different set of people (or sometimes the same people in a different set of roles) put together a 6-year Capital Improvement Plan. A third set of people deals with annual budgets. A fourth set operationalizes that. A fifth set actually builds and delivers the projects.

As the wise show *Parks and Recreation* said 'There are no planning emergencies.' With the attitude in contrast to most people who live in the now and with urgency, who spend their lives metaphorically if not actually 'fighting fires,' it is no wonder that planners cannot meet deadlines. In their worldview, there are no deadlines.

26 Deconstructing Busytown

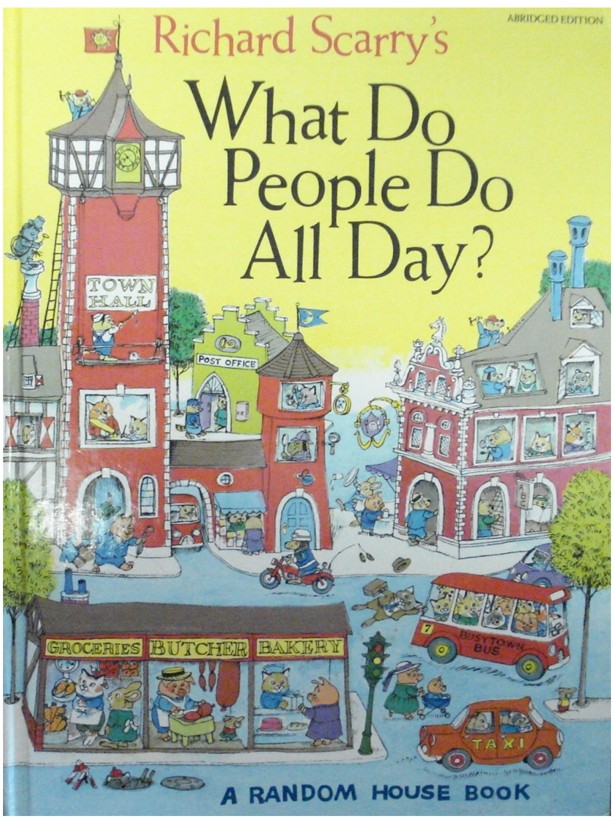


Figure 26.1: Cover of Richard Scarry's Book *What Do People Do All Day?* (1968)

Originally published as Levinson, David (2006-04-29) Deconstructing Busytown.

Fictional worlds provide insights into the perception of cities. My first understanding of how places work probably came from the book *What Do People Do All Day*?[1] by children's author Richard Scarry. The Busytown in which this book (and others) are set faded from my consciousness until my son was born, and we decided to go shopping for books again. Rereading the book from an adult (and planning and transport professional's) point-of-view

[1] (Scarry, 1968).

provides a new perspective on the Scarry memes that have shaped the neural networks of millions of young minds. Estimates suggest that over 300 million copies of Scarry books are out there, no small set of infected brains inculcated in the idealized place of Scarry.

I was raised on the 1968 version, and have acquired the abridged (and apparently censored) 1976 version for my son. A number of people have critiqued Scarry for his implicit sexism, a large number of women work at home or in other traditionally female occupations (teacher, nurse). The Scarry world-view is traditional, and I won't pile on in that regard. But the world is traditional in other ways as well, and that is its view of the city.

Scarry moved to Switzerland in 1968, and Swiss architecture permeates the old town center of *What Do People Do All Day*. The Town Hall of Busytown on the cover (Figure 26.1) is nothing if not Tudor. There is a small gate through which a small car is driving. Something to note about the vehicles in Busytown is that they are all just the right size for the number of passengers they carry. The bus on the cover is full, with a hanger-on. The taxi holds one driver in the front and one passenger in the rear. The police officer (Sergeant Murphy) is riding a motorcycle. When he has a passenger, the motorcycle always has a sidecar. Similarly, each window in town has someone in it, sometimes more than one person. Of course, this is a busy town, so the activity makes sense. The cover of this includes the grocery store, butcher, and baker (no supermarkets in 1968 Busytown), one block in front of Town Hall. One thing to note about the Butcher is that he is a pig, and clearly butchering sausages. Anthropomorphism is a standard feature of children's books, so that shouldn't disturb us. The cannibalistic autophagia: a pig serving one of his own (presumably sometimes to other pigs, though on the cover the customer is a mouse), does disturb. It is a common feature of American restaurant signs to feature a smiling animal (e.g. the happy pig chowing down at a rib shack) encouraging you to come in and eat. One is somehow more comforted with ads of cows holding signs saying 'Eat mor chikin!' (remarkable more not for the misspelling, but for the fact that cows can write at all with their hooves).

On the cover, the post office is just behind Town Hall, a hotel next to that is shown inside on detailed pages. The police station is located next door to the Town Hall (separated by the town gate and a newsstand), a detective agency on the second floor, and a watch-repairman upstairs from that. If the police don't give you satisfaction, you can go upstairs and hire your own private investigator. So public buildings seem to share space with private

businesses. Just left of the town hall is a residential building (perhaps medically oriented). Left of that (on the back cover, which is continuous with the front), and across the street are the public library and school.

The building to the right of the police station, separated by a small plaza, includes a café, printer, newspaper, and bookstore on the ground floor, a photographer, secretary, and telephone operator on the second floor, and an artist studio, story-writer, and poet above that. A very high density mixed use collection of small businesses all themed around communication.

Page 4 shows another picture of the town center area, though not obviously connected to the first picture. There is a building with a music teacher and dance studio. To the right of that across the street is a building with a bank and drug store on the ground floor, and upstairs includes a dressmaker, beauty parlor, and realtor, and on the top floor, the medical complex including dentist, doctor, and optometrist. Even in Busytown, the medical professionals co-locate. Perhaps they are sharing a receptionist (like in the Bob Newhart Show), it is hard to say.

Next door and across an alley is a barber, and upstairs (up a hill, so the second floor has ground access as well) is a hardware store. Home Depot has yet to arrive. The top two floors are residential, the 'Ritz Apartments'. Across the street is an automobile showroom, in the style more commonly found outside North America where it features only one car in the window and there are other uses in the building. Behind that is the fire station.

We learn on later pages that some businesses appear more than once. Grocer cat seems to have at least two small food stands, the stand on the cover is clearly different than the one on page six. There is also more than one bank, the downtown bank on page four (run by a raccoon) is in a large building, but there is another bank on page seven, with a different (this time pig) banker.

We discover that town includes a tailor and a blacksmith shop (who fixes tractors). There are construction workers in town, who work in the field at construction sites. The infrastructure of the house they are building is surprisingly accurate, including water and sewer, and forced air heating. The electrical is governed by a fuse box, while the telecommunications wires each room with a fixed-line telephone (this was 1968 after all).

We follow a letter from Betsy Bear (in Busytown) to Grandma Bear (in Workville) The postmaster in Busytown sorts letters by hand into cubbyholes labeled by destination; all letters to Workville are put in a bag and on a plane. Though there are no apparent zip codes,

one letter carrier in Workville is named Zip. After some confusion, Zip delivers the letter to Grandma's house. Grandma is delighted to have received the felicitous missive from her granddaughter. The post office still sells airmail stamps for only 8 (cents?), and postmarks are applied by hand, but the post office today works remarkably like that of 1968.

The firefighting system differs from today through the use of fire-alarm boxes, rather than 911. The advantage of boxes of course is the built in locational information, which was not available until recently with land-line phones, and only recently on mobile phones with GPS enabled. (For that matter, my phone company does not even have effective caller-id, especially after they transfer me seven times). If someone pulls the level of fire-alarm box number 3, that helps send the firefighters on their way. The firefighting equipment is similar to that of today, the trucks are the iconic red, though there is a lot of equipment deployed for a small house fire (at least five vehicles).

The medical system we learn about through Abby's visit to the hospital for a tonsillectomy. Doctor Lion, who has both a practice and hospital visiting rights, performs the surgery. However Abby's mom can't stay, it turns out she is about to give birth to a baby brother for Abby. Mom came to the hospital in an ambulance, the old station-wagon style ambulance. I hope they have good insurance, still they will see bills and statements for months.

The Pig family takes a train trip to visit relatives. The day of the trip Daddy buys tickets at the train station. Note that there are no advanced purchases required, and there must be space on the train. The train looks quite crowded in the picture, so maybe daddy lucked out and got the last available seats. The station has a newsstand, and porters help passengers with their luggage. A vendor sells snacks on the platform. The trip requires a transfer (not only are they taking a train, they are taking two trains). The second train is much more modern, and has a sleeping car, dining car, and mail car, and is powered by a diesel-electric locomotive. The train has a conductor who collects the tickets. The mail is thrown off the train at the local train station without having to stop. There are at-grade crossings, protected by gates, but the gates are not machine controlled. The amount of labor involved in this trip must make it expensive. Eventually the pig family's overnight trip ends when they arrive at the Wiener Schnitzel station.

As a professor who teaches transport engineering and planning, I took a special interest in the chapter 'Building a new road'. It begins 'Good roads are very important to all of us.' And of course, they are. The problem it seems is that Busytown and Workville are

connected by a bumpy, crooked, dirt road, which becomes a mud pit when it rains. The towns are not that far apart (despite the fact that Betsy in Busytown needed airmail to send a letter to her grandmother in Workville, but perhaps the planes are needed because the road was so bad). The mayors of the two towns talk to the Chief Road Engineer and agree to pay him to build the road. So road construction seems to be private, or at least on a contract basis with some other agency (a state department of transport?). A great deal of modern construction equipment is used to build an asphalt road with an aggregate base. The bridge though is stone construction, and seems very labor intensive. The road itself rides smoother and is paved, though it still seems crooked, perhaps there were difficulties in right-of-way acquisition – this could have been a problem if the road were privately owned, though one might think that a public agency would have acquired the right-of-way first through eminent domain. The road, a two-lane, signal controlled, undivided highway, with streetlights, signs, and guard rails, provides a rest area with a snack bar (managed by a mouse or rabbit serving pork, at least there is no cannibalism) and gas station. The signs are non-standard (for either the US or Europe), and this might create some confusion and be the cause of future incidents.

As is true of all Richard Scarry stories, the dividing line painter truck manages to run off the road. In the end, there proves to be a great deal of induced demand, as there is a rush to use the road when it opens, and the police are required to keep order.

In other chapters we learn about agriculture and forestry (including a water-powered saw mill), as well as ocean travel. Not content with just one book, Scarry, like many fantasy and science fiction writers, milks his universe with multiple titles. These may give insight into the evolution of urban form since 1968.

Busiest People Ever,[2] released in 1976, gives us further scenes about town. We see a street with a bakery, watch shop, toy store, dress shop, and a one-screen movie theater. The architecture appears American from the early twentieth century, a lot of 'taxpayer' blocks with single story construction. Another street scene has a church, across the street from a TV shop and bookstore. The next block has a police station, delicatessen, and candy shop. This street ends on a block with a sporting goods store and optician. The road line painter is of course drawing crooked lines. The final two blocks of this shopping district feature a drugstore next to a hardware store, hat shop, and florist, and a building with a shoemaker, electric supplies, and groceries. These are apparently different buildings than found in 1968, or are in a different business

[2] (Scarry, 1976).

district (since we no longer see the Tudor Town Hall).

Another area has a fishmonger across the street from a two story building with jeweler, sign painter, umbrella, ice cream, antiques, and tailor on the ground floor, and artist, sculptor, lawyer, dancing school, singing lessons, and window washing upstairs. One gets the feeling this is a low rent area, after all, does the window washer need a high-rent location? Well, no comic books stores or karate studios.

The train station has gotten much bigger, there was clearly a growth spurt in town. In another business district there is now a drive-in bank, a second school, another post office, which takes up two storefronts, music shop, and a restaurant. The people of Busytown may be eating out more. Across from the restaurant there is also a coffee shop, next to a bike shop. Lest you think the residents are health nuts though, this is next to another auto dealership. On the next block is an office of another local newspaper; Busytown c. 1976 can support two papers. These will eventually merge.

Another road is under construction; the interstate era is upon us. The road includes a gas station with two pumps now, and the road features a roadside emergency telephone. The port still does not have container ships though. The airport gets flights from Swissair (RIP) as well as air cargo flights, and seems much busier.

[3] (Scarry, 1994).

Busy, Busy Town,[3] published in 1994, reworks many of the same themes. In our world 26 years after the creation of Busytown, and 18 years after *Busiest People Ever*, the library now shares a building with the bank, some offices, a writer and a painter. We discover that 'The best writers write children's books', though I think the best writers write about children's books.

On Main Street (which is clearly marked), the drug store, hardware store, shoe repair and grocery store share one block. A laundry, candyshop, bookstore, and barber share a second. These buildings are only one story though. Maybe suburbanization has struck, this could be Main Street Extended, it clearly illustrates a different urban landscape from the old Tudor town center area. We explore the post office, school, home, the hospital (we find Dr. Lion still practicing). The people who keep Busytown clean now include now include a recycling crew, as well as junkman. We learn that 'Someday the garbage dump will be a lovely picnic ground.'

Again, there is a fire, there are home fixer-uppers. The interesting thing is that first, they all showed up for work the day that Mother Cat called them, and second they are all coordinated, so that the as the plasterer is finishing, a painter can follow up within no time, and then a paperhanger puts on wallpaper, all without stepping on

each other's toes. We learn about lumber, wood-working, farming, and the streets of Busytown. The streets have many street cleaners, but still the infrastructure is in disrepair. There are water pipes and electric wires under the street needing fixing, a worker breaking the street with his jackhammer, and another worker using asphalt to repair potholes. On the surface, there is a hotdog vendor and ice-cream man in his truck.

A large variety of trucks and cars populate the streets of the city. Just like their infrastructure, the people of Busytown have difficulty maintaining their fleet. (Perhaps it is the lack of opposable thumbs afflicting the populace). Many cars are broken-down and found at a service station that both sells gas and services cars, which is definitely a throwback to an earlier era. The railroad operates coal-powered locomotives on a single-track system that uses signal controls. The harbor is also a busy place, however containerization does not seem to have hit, items are off-loaded with an on-boat crane, and they are not in large containers. There is inter-modalism, as the machines are loaded directly onto flatbed rail cars.

The past 26 years saw a major upgrade to the Busytown Airport, including a jet pilot wearing a space-helmet. Unconcerned, the pilot allows Lowly Worm into the cockpit, a security breech that would no longer be tolerated.

Apparently there is a supermarket now in addition to the grocery stores. The butcher at the market (maybe the same pig, maybe a different one) is grinding hamburger. At least it isn't pork. The baker is also a pig, but the other workers seem to include both cats and rabbits. Maybe the supermarket is really just a cooperative of local merchants, rather than a national chain. Evidence for this includes a cash register that is the old-fashioned style: it does not include a UPC scanner.

Busytown requires police to help give order to their chaotic lives. The police in town direct traffic (the traffic signal infrastructure is inadequate or broken), find lost children, give parking tickets, chase speeders, and tend to auto accidents. Four out of five of their daily jobs are related to highways.

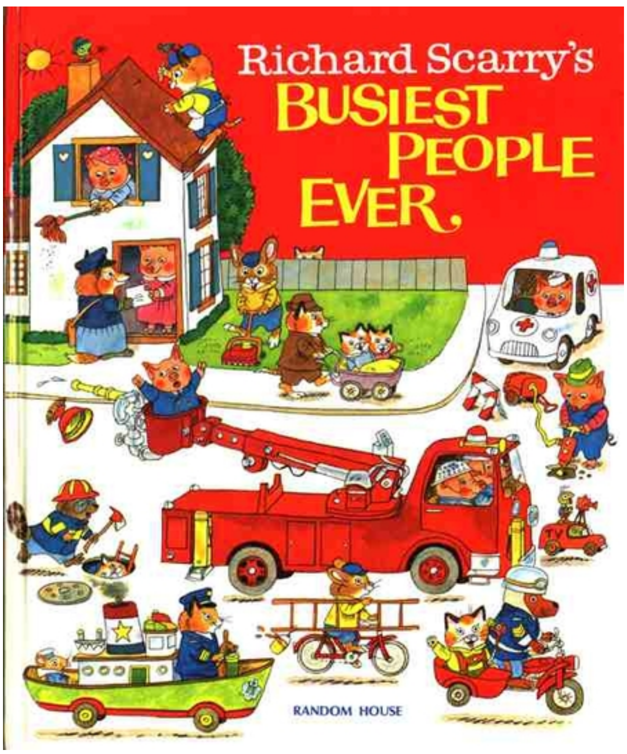
The world of Busytown is indeed busy. The port and airport indicate a city of between 500,000 and 1,000,000 people; though clearly a town that large would have more stores, perhaps we only see a glimpse into the retail activity. Scarry creates other less well-defined places in his other books. They are more American in style, but less coherent somehow than his Busytown books. Raised on Scarry, I came to associate place with having a certain set of activities. The local shopping area should have a butcher, a bakery,

a hardware store, etc. Busytown seems stressful. While no one is murdered, there is a fire in almost every book, traffic crashes among well-known members of the community, and many hospital visits.

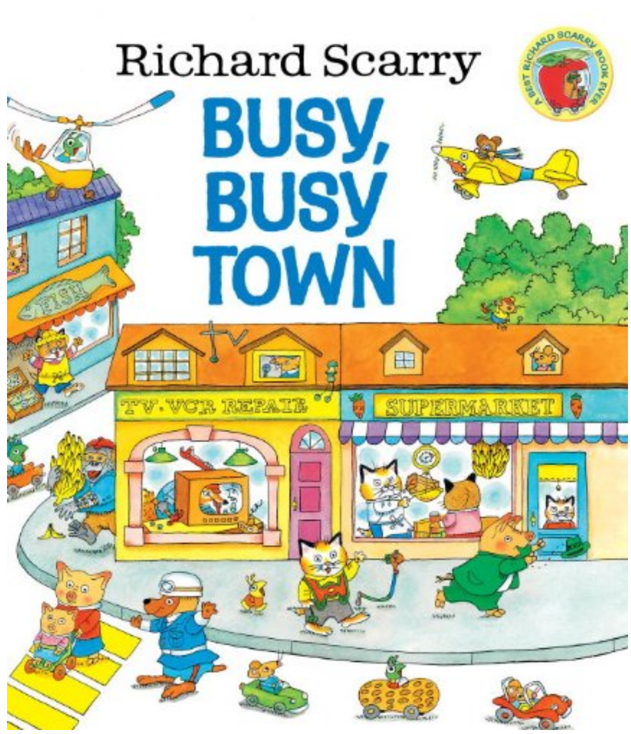
Is Busytown a spontaneous city? One could argue it is. Clearly there is a dynamic evolution of Busytown's urban form over the period from 1968 to 1994. New businesses are opened, a supermarket seems to replace some older food vendors (butcher, baker, grocer). Forms not known at the time the town was founded (and judging from the architecture, the old town is at least 19th century, and possibly earlier) rise to prominence. While the town is slow to take up some technologies (computing, containerization), air travel is advanced. The town is also slow to abandon some older forms (passenger rail service with coal powered steam trains). The physical network also changes, roads are being built, the newer ones better than the old ones. Roads can be built quickly it seems, the mayors go to the road engineer and one page later, construction has begun. If someone has a whim, they can probably find a store or service that will meet it, so they can spontaneously choose to undertake an activity. Daddy buys train tickets the same day of the trip. In order to accommodate spontaneity, of course, the railroad had to be there. The town is created and recreated in a spontaneous way, yet it feels very ordered, the town is the right size for its population. The people act in a spontaneous way, which may get them in trouble, but the police are available to restore order when necessary. In short, it feels balanced, options are available, but only as many as the town can support. Ideas, like new roads, can be quickly implemented, though one wonders why it took until 1968 to pave a major road to a nearby town and 1976 to get a freeway.

Category	*What do people do all day?*(1968)	*Busiest People Ever* (1976)	*Busy, Busy Town* (1994)
Grocery/Supermarket	2	1	2
Bank	2	1	1
Airport	1	1	1
Artist studio	1	1	1
Bookstore	1	1	1
Drug store	1	1	1
Gas station	1	1	1
Hardware store	1	1	1
Police	1	1	1
Port	1	1	1
Post office	1	1	1
Restaurant	1	1	1
School	1	1	1
Train Station	1	1	1
Autos	1	1	0
Baker	1	1	0
Barber/Beauty Shop	1	0	1
Café/Coffeeshop	1	1	0
Candy Shop	0	1	1
Dance studio (school)	1	1	0
Dresses	1	1	0
Hospital	1	0	1
Library	1	0	1
Music teacher	1	1	0
Newspaper	1	1	0
Optician/Optometrist	1	1	0
Shoemaker (repairs)	0	1	1
Tailor	1	1	0
Watches (sales, repair)	1	1	0
Writer	1	0	1
Antiques	0	1	0
Bike shop	0	1	0
Blacksmith	1	0	0
Butcher	1	0	0
Church	0	1	0
Delicatessen	0	1	0
Dentist	1	0	0
Doctor	1	0	0
Electric supplies	0	1	0
Fire station	1	0	0
Fishmonger	0	1	0
Florist	0	1	0
Hat shop	0	1	0
Hotel	1	0	0
Ice cream	0	1	0
Jeweler	0	1	0
Laundry	0	0	1
Lawyer	0	1	0
Movie theatre	0	1	0
Music shop	0	1	0
Photographer	1	0	0
Poet	1	0	0
Printer	1	0	0
Private Investigator	1	0	0
Realtor	1	0	0
Sculptor	0	1	0
Secretary	1	0	0
Sign painter	0	1	0
Sporting goods	0	1	0
Telephone Operator	1	0	0
Toy Shop	0	1	0
TV Shop (Electronics)	0	1	0
Umbrella	0	1	0
Window washing	0	1	0

Table 26.1: Table of businesses in Scarry's Busytown by Book.



(a) *Busiest People Ever* (1976).



(b) *Busy, Busy Town* (1994).

Figure 26.2: Covers of Richard Scarry's later Busytown books.

27
Spontaneity in a Can, Spontaneity in a Plan

Figure 27.1: Street performers in Shinjuku, Tokyo, Japan

Does spontaneity come in a can? Though it appears in a few plans, the word 'spontaneous' is rarely uttered as an adjective of praise from uttered by planners' lips or dripping from their pens. It is often coupled with words like 'housing encroachment,' something that upsets order and is to be avoided. In contrast, the phrase 'spontaneous order' is popular with those who follow von Hayek and other Austrian Economists, as it is what emerges from unfettered markets in admittedly idealized conditions.

Among planners, the only positive connotation of 'spontaneous'

seems to be that of a designated place (or transit vehicle) which allows or promotes spontaneous interaction or conversation, or performances like busking. More often, semi-synonymous terms like 'vibrant and healthy' or 'lively' are used.

- The City of Wellington New Zealand, asserts 'We love street performances in Wellington,' has a 28-page policy outlining the rules of street performance such as busking and other acts to deal with 'tensions between the needs of inner city residents and street performers.'[1]
- Bethesda, Maryland in Montgomery County, where I worked and lived, aims to 'Realize the vision of Bethesda as a diverse and lively downtown for Bethesda-Chevy Chase. Continue well-designed redevelopment within the Metro Core and reinforce the physical character and varied activities of districts radiating out from the Core so that each district has a distinct identity yet is linked into a coherent whole.'[2]
- Ames, Iowa, the home of Iowa State University says 'Sound commercial land use planning is needed to assure that the City of Ames commercial marketplace remains healthy and vibrant.'[3]
- Georgetown, Kentucky seeks 'a balanced cross-section of cultures and income levels, for a vibrant and interesting community.'[4]
- Vancouver, Canada wants to plan spaces for 'spontaneous activities.'[5]
- The University of British of Columbia in Vancouver identifies its promenade to be '– an opportunity for spontaneous activities, informal celebrations and hallmark events.'[6]
- Washington DC encourages facilities for 'spontaneous performances.'[7]
- Squamish, Washington presents its waterfront as a 'dynamic gathering space for spontaneous meetings.'[8]
- Melbourne, Australia aims to 'facilitate spontaneous conversation between strangers' with its public transport.[9]

Yet aside from formal governmental plans, there are numerous interesting examples one could look at. There are various types of places which involve different types of planning by non-governmental agents:

- Event Cities – Fairs, Festivals, Shows, Conventions, Sports (Section 13.5).

[1] (Wellington City Council).

[2] (Montgomery County Planning Department, 1994).

[3] (Ames, Iowa Planning Department, 1997).

[4] (Georgetown-Scott County Planning Commission, nd).

[5] (Social Issues Subcommittee, 2001).

[6] (University of British Columbia, 1999).

[7] (Washington, nd).

[8] (Squamish Downtown Waterfront Initiative).

[9] (Coalition for People's Transport, 2004).

- Enveloped Cities – Skyways, Subways, and Shopping Malls (e.g. Chapter 13 and Section 13.1.)

- Planned Cities – Columbia and so on. (Chapter 3).

In addition one could compare cities/places that have various degrees of land use control and various degrees of spontaneous action. New York has a high degree of spontaneous action, and probably once had a high degree of spontaneous development (though this was on a pre-specified grid network).[10]

[10] (Ballon, 2012).

One of the features of modern planning is the attempt to provide vitality (or spontaneity) in the urban environment. The festival marketplace is a classic example. If only we can create an exciting, but controlled atmosphere, then we will have achieved the best of spontaneously arisen places without their defects. The market for these festival marketplaces has been mixed though. For every success like Baltimore's Harborplace or Winnipeg's The Forks, there is an economic failure like Toledo's Portside or Minneapolis's St. Anthony Main. In the St. Anthony Main complex, the very regulation that aimed to limit the negative effects of the marketplace, in particular late night bars, minimized spontaneity to the point of failure.

Similarly cities try to attract artists and other members of the so-called 'Creative Class' to boost urban vitality and, in theory, economy.[11] This includes subsidizing housing for artists, as in the Pillsbury A-Mill adjacent to St. Anthony Main.[12]

[11] (Florida, 2014; Markusen and Gadwa, 2010).

[12] (Jossi, 2013).

Unlike Spam, vibrant spontaneity does not come in a can, it is not some formulaic easily reproducible phenomenon that can be dictated in a plan. Most planners are trained to assume centralized planning produces better outcomes; instead they should consider the proposition that reaction is sometimes better than pro-action, and that spontaneity and flexibility can be a positive force for economic dynamism.

Figure 27.2: Street performer in Santiago, Chile, with Piglet. Photo by author.

28
Building the City Spontaneous

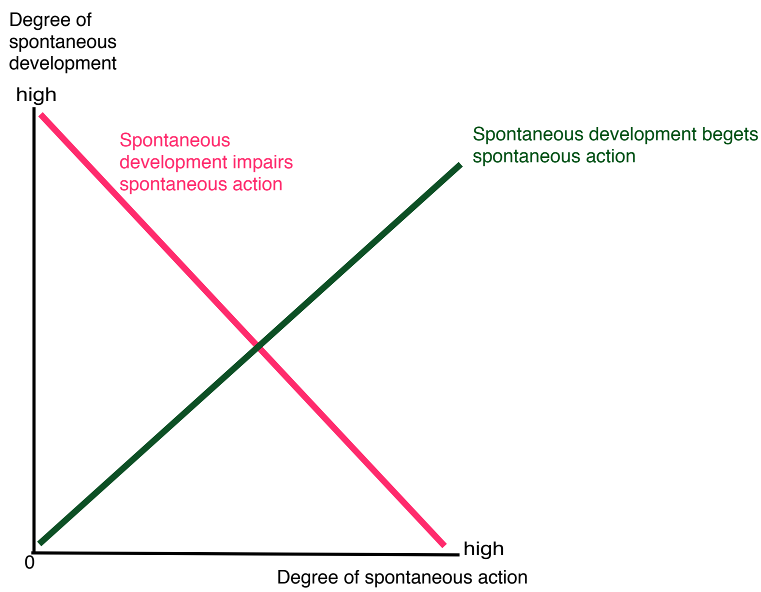


Figure 28.1: Spontaneous development vs. spontaneous action.

Originally published as Levinson, David (2007-07-13) The Spontaneous City. Transportist.org

Land use planning is antithetical to spontaneous action. While in Montgomery County, Maryland (1989-1994), I worked on a number of plans and policies. The most significant of these was the Annual Growth Policy (AGP) which aimed to regulate the pace, rather than cap the zoning, of development.

Zoning was the primary regulatory tool land use planners developed. Zoning, a restriction on the type and intensity of use, would implement plans, and provide a very microscopic 'vision' for individual parcels. Zoning provided certainty at the cost of flexibility. It also capped density in many places, perhaps below

where the market density would have been.[1]

Zoning is not a requirement in all cities, Houston, Texas is often pitched as a city without zoning, though there are contractual covenants and other private equivalents of zoning in many areas of the city. [2]

By regulating pace differently in different areas, Montgomery County also affected the sequence of development. The AGP did not intend to affect the ultimate amount of development of an area, that was left for the plan and implemented in zoning.[3]

There were a number of flaws with the AGP, but one I thought most important was the attempt to pro-actively anticipate the future rather than responding to decisions. The AGP established 'staging ceilings' for each area of the county (about 30). The staging ceiling was the maximum number of jobs and housing units permitted in that area, so that public facilities would be adequate. One fundamental difficulty was that the optimal number for one area depended on what actually happened in other areas, which of course was unknown until that development actually occurred. Thus the staging ceilings in one area were conditioned upon ceilings in another area, that may or may not have been exceeded. There were lots of ways ceilings could be exceeded, but if the ceiling were exceeded, the area was placed in moratorium for new development.

This experience, contemporaneous with the fall of Communism between 1989 and 1991, shattered my naive beliefs about planning, and along with reading Hayek's *The Fatal Conceit*, it also shattered beliefs in the possibility of forecasting.[4]

A notion I had while at MNCPPC-MCPD was the idea of *just-in-time* or *dynamic planning*. Instead of trying to proactively predict the future, could we just respond to market proposals with a yea or nay (and other feedback). In other words, shift from proactive to reactive regulation. A proposal comes in, we run it through the transportation model. If the proposal met adequacy standards, it would go forward, if not, it would be rejected. The standards would not be site specific, but instead be geared toward assessing things public agencies should be concerned about, namely ensuring public facilities remained adequate. I was thinking mainly about replacing the AGP growth management system, rules about zoning and so on were not really in my purview. This was really more like dynamic regulating than dynamic planning.

The difficulty raised with this is that it reduces certainty for private-sector actors, who under the AGP at least knew in advance whether public facilities were deemed adequate. Certainty is not the only value on which a public policy should be judged. A county

[1] It is very difficult to do counterfactual analyses, and the extent to which zoned density exceeds actual density we can say that the market requirements were lower than the zoning, but when the actual density equals the zoned density, the market desires were probably greater than that permitted, but by how much is impossible to say with certainty.

[2] (Siegan, 1970; Qian, 2010).

[3] (Levinson, 1997).

[4] (Hayek, 2011).

could establish certainty by prohibiting all development, and that would not be good for the private-sector either. Further, developers who have already been approved might like the idea that their competitors cannot go forward because all of the available infrastructure capacity has already been committed to their projects.

The second notion came later, while a graduate student at the University of California, Berkeley, as a way to replace zoning. The role of the public would be to approve a *vision for the future*, and the role of public servants is to facilitate and enable that vision. The vision is not generally site-specific but vague. Development would be judged by whether it moved toward the vision or against it. No plan would be written, no zoning enacted, only the vision would be expressed.

This decreases certainty even more. But it challenges developers to achieve consensus with the neighbors of potential projects. As always, there is a risk of 'not in my backyard' (NIMBY) behavior, but there is an opportunity now for side payment to the neighbors who will potential suffer actual quality of life loss due to additional crowding and congestion.

Spontaneous development would still need to respect property rights and rule of law, though the law would be more limited than found in many places today.

DOES LAND USE PLANNING LEAD TO MORE OR LESS SPONTANEITY? Land use planning emerged for a reason, it was a response to the negative features of unplanned, uncontrolled development. Some people did things, like build quarries or operate late-night drinking establishments, that really upset their neighbors. The 'nuisance' lawsuit was thought to be insufficient, and quite reactive. Would it be possible to proactively avoid this problem?

Land use and transport planners seek to impose order on the development process. The very name of the profession 'planner' indicates that they draft plans. Planners want to know the future, and develop regulatory tools to help them control this future. Plans aim to take the chaotic, unpredictable, evolutionary process of development of both places and infrastructure and put a sheen of order upon it. Yet they have significant theoretical problems.

- PUBLIC SECTOR TRANSPORT AND LAND USE PLANS ARE STATIC. They are made for one point in time. They are snapshots in a world with 24 frames per second (for eternity), and for which we don't know the ending ('no spoilers').

- THE MIRROR OF THIS PROBLEM IS THEY IGNORE THE PATH, as well as changes in behavior and technology that may occur in the interim.

- PLANS DESIGN FOR MATURITY AND IMPLICITLY ASSUME THAT THE MATURE (BUILT OUT) CITY SUSTAINS. The evidence from the life-cycle for every mode (or technology) is that its scope and extent are continuously changing. Planning can work within the lifecycle of a given technology, but cannot jump between cycles. Today's plans for instance systematically ignore the emergence of autonomous vehicles.[5]

[5] (Guerra, 2016).

- YET, THEY ADDRESS FUTURE PROBLEMS THAT DON'T EXIST TODAY, (e.g. future congestion from future development) when there are plenty of problems today that remain unsolved (today's congestion from yesterday's development). Trying to better manage how will people get around or from or to a site which might (or might not) transform from country to city, or even low density suburb to high density suburb, in 30 years when there are plenty of ways to help people get around better today is an exercise in pointlessness, whose primary objective is to transfer resources from the public to selected (and one presumes politically influential) landholders.

A vision presents a direction in which to proceed. The most important thing is the next step (or two) though. Each step you take in one direction is a step farther away from destinations in other directions. But the path on which we are walking is shrouded in smog. Our vision is simply our imagination (or consensual hallucination) of what lies down the road. We have never been there before. But we must recognize, we never will reach where we think we are going.

So can we plan and regulate cities to achieve more spontaneous action than an unplanned city? Presently, that question must remain a question, the question of 'can we plan . . . ' is very different than 'do we plan . . . .'

There are two core theories of this

THE FIRST, OR 'MARKET URBANIST' APPROACH, makes the claim that the *agglomeration benefits* of cities are strong, and zoning restrictions on the intensity and type of use of land limit these agglomeration benefits. The empirical evidence is that larger cities are more productive.[6]

[6] (Melo et al., 2017)

The second, traditional planning regulatory framework in place since the establishment of zoning in the first half of the twentieth century, makes the claim that *negative externalities*, like crowding, congestion, pollution, and noise are the dominant features of large cities and therefore land uses need to be regulated to reduce if not prevent these externalities.

Obviously, both of these perspectives have valid points, though it is an open question if land use regulation is the appropriate way to deal with externalities rather than road or pollution pricing. It is at best a second-best solution, and not an efficient one at that.

Simultaneously, in some regions planners also regulate the development of rural areas with urban growth boundaries, to prevent the costs of sprawl. This thereby drives up demand for land where it is permissible to develop, and thus raises costs (and the value of property existing landowners). It does however force more development into those regions, and increases local agglomerations by changing the cost structure of real estate. This should have some positive spillovers if there are the benefits to agglomeration as claimed.

28.1 *Spontaneous development vs. spontaneous action*

On the x-axis of Figure 28.1 we have degree of spontaneous action, with the zero point marking a totalitarian city under siege with a curfew imposed, and the right point complete freedom to consume whatever the market can produce. On the y-axis we have degree of spontaneous development, with the zero point marking a highly planned communist state and the topmost point complete freedom to develop. The question is, what is the shape of the curve? Does spontaneous development enhance or constrain spontaneous action? Is there any relation?

My perception is that the evidence to date is that land use planning, by restricting spontaneous development and constricting interesting uses of existing buildings generally makes spontaneous action more difficult. While planners coordinating development may provides some order and produce spillovers increasing activity, the vast majority of planning activities are regulatory and aim to reduce unplanned and unanticipated activity. In Figure 28.1 reality is on the green, rather than red, line, but regulation puts us nearer the lower left than the upper right.

If planning were to charge development based on the negative externalities it imposed and costs it incurs, for instance through impact fees, rather than constrain it to avoid all possibilities of some

particular externality, it would work with the market instead of against, and provide more choices and opportunity, rather than fewer.

In contrast with land use planning, transport planning can increase spontaneous action. As noted earlier, the hierarchy of roads is both an emergent and a directed process. In practice, in the modern United States and many other developed countries, network additions are mostly centrally pre-planned. While there may not be one master plan for the whole region detailing every street and alley, the broad strokes, and the major lines, of today's proposed roads and transit lines were often drafted decades ago. In many cities street grid itself was surveyed in rectangular fashion constrained by that original enabler of orderly development, the Northwest Ordinance of 1785. Other cities, like New York, saw a grid sketched out in the early 19th century that undergirds the economy today. By providing a regular system of access, these preplanned streets and highways permit today's travelers to engage spontaneously. They need not await construction of a bridge before they can cross the river, it has already been built. They can hop on a bus, since there is already a bus; they can jump on their bike, since there is a bike lane; they can walk, since there is a sidewalk; or they can drive, since there are streets and highways. Spontaneous action happens because someone thought pre-provision of access was a good idea.

This is not to say all transport plans or facilities are good. That is far from true. It is just to say that providing the lattice on which people act is a necessary function, and a planned lattice can probably perform better than an unplanned one, which did not account for future uses.

29
Framing Regional Development

Figure 29.1: Minneapolis Skyline, from Tower Hill Park. Photo by author.

Originally published as Levinson, David (2012-03-25) Framing Regional Development. I was asked to talk to the Metropolitan Council about their Regional Development Framework, this is what I said. This chapter is based on, and extends, a presentation to the Metropolitan Council of the Twin Cities.

THE GOAL OF A REGION'S DESIGNERS, AND OF THE CITY ITSELF, IS TO MAXIMIZE ACCESSIBILITY. Cities (metros) have one purpose, to enable individuals to engage in as much spontaneous action as possible: To reach more things in less time. These things include jobs, friends, mates, security, supplies, entertainment, and so on. If you do not wish to reach these things, you should not live in a city.

This has two aspects:

- Where can we put *more things* (land use) and
- How do we ensure we spend *less time* (transportation).

Transportation and land use cannot be treated in isolation, they need to be arranged relative to each other. Similarly policy and physical design need to be coupled, not divorced.

There are a variety of strategies to try to achieve this goal.

1. Adaptability, Scalability, and Flexibility. The future is uncertain. When the street grid was laid out in the 1800s, no one seriously planned for the automobile. The grid nevertheless adapted. The street grid was remarkably *scalable* (able to grow or shrink with the city), serving a city of a few thousand and growing to serve a city of a few million within mostly the same right-of-way. Cities grow and shrink. Infrastructure designs should be able to grow and shrink with them. What if the city were twice as populous? Ten times? What would change?[1]

[1] The Metrodome provides a good example of the difference between *adaptability* and *flexibility*. The Metrodome (1983-2014) was a domed stadium in Minneapolis that served the Minnesota Twins baseball team, the Minnesota Vikings NFL team, and the Minnesota Gophers college football team. It was *flexible*, in that it could do many things. It was pretty basic as domes go, and had embarrassing incident when the roof collapsed under snow. It was demolished to be replaced by a more modern stadium serving primarily the Vikings, the Gophers and Twins having already departed for more Elysian Fields. It was thus not *adaptable* to changes in the demands of sports team owners.

2. Resilience, Reliability, and Robustness. As we learned in 2007, the I-35W bridge was structurally deficient and fracture critical, and so once one element failed, the whole bridge did as well. Fortunately, the street network is not critical in the same way. When one link failed, people adapted well, finding alternative routes or destinations. Networks do have vulnerabilities (selected choke points) which both need to be made more *resilient* and less likely to fail, and need *redundancy* in case they do fail. Transit services are also vulnerable to strikes (e.g. 2004). We have basically one provider (and its unions). Multiple providers, contracting, franchises, etc. are strategies that metropolitan areas should seriously consider when organizing transit services. It is unusual in the US, but typical elsewhere in the world where transit actually works well.

3. Skate to where the puck will be, not where it is. We know some things about changing technologies. While we cannot fully anticipate what those changes will be, we expect the future is not like today. Yet essentially none are acknowledged in planning and forecasts, which assume technology and behavior are quite fixed. This leads to the next strategy.

4. Scenarios not Forecasts. The future is uncertain. Despite best efforts, forecasts have been terribly inaccurate. There are 'black swans' everywhere. We need to consider a large set of possible outcomes and plan for those rather than one 'expected value.' This reduces risk, enhances reliability, robustness, and resilience.

5. Reinforce Success, Cull Failure. We need to be active Darwinists. If a strategy is successful, do more of it. If it is unsuccessful, stop throwing money at it. Resources are scarce. Money, time, energy, effort spent on losing strategies cannot be spent on better ones. Admit failure (at least of your predecessors). Not everything your agency has ever done is a success. You are not the Pope.

6. Recognize Lifecycle. All technologies go through birth, growth, maturity, and decline stages. Plan accordingly. Do not invest in expensive capital projects for mature technologies. Learn to manage instead. For decades we have climbed down Mt. Transit and up Mt. Auto. This means we have changed our urban form to one centered on people relying on transit to one relying on the auto. The more we climb up Mt Auto, the farther we are from the peak of Mt Transit. We cannot easily go back (nor should we necessarily do so). What is our next technology, what has peaked, what is truly growing?

7. Flatten Hierarchies ('The City is not a Tree' as discussed in Chapter 3) Connections allow multiple paths, reduce vulnerability, and increase interactions. At a spatial level we see this with cul-de-sacs, which put all their eggs in one basket. If the entrance to a cul-de-sac is blocked, the residents are cut-off. In contrast a more robust network has multiple pathways, no one can be cut-off with a single disruption. This is not just a prescription for transportation networks, but for a whole range of policies. This reduces risk, enhances reliability, robustness, and resilience.

8. Information everywhere. Information wants to be free. Stop making it expensive. Parking regulation signs have more information density than the typical Bus Stop sign. In order to feel comfortable traveling everywhere, I need to have ready information at my fingertips or eyeballs about where and how I go next. I have to have confidence this information will also be available at my destination. Information increases usage. Providing a service that no one knows about is as useful as not providing the service at all. About 1 percent of Twin Cities trips are by transit. There are many reasons for this. One of them is information.

9. Preserve and Maintain. The most important designs are the

ones already built. Unless and until the existing system is properly maintained (or gracefully abandoned), new investment is unwarranted. Existing lines have proven value. Losing them will have known costs to the disruption of travel, social, and economic patterns. But beyond maintaining the existing system, we should design systems that are easier to maintain. Consider how the system will be operated by both users and infrastructure managers at the time of the design, not just how we imagine it looks on opening day.

10. INCENTIVES MATTER. People, firms, governments, respond to incentives. Structure the game so the incentives align with ends. Examples follow:

    (a) *Loans not Grants*. What about a Metropolitan Investment Bank rather than grant programs? Lend money to communities who want to do things (infrastructure, buildings), on the condition they pay it back over time (from user fees, value capture, etc.). Local governments will only do things that are worthwhile. Chicago is doing something like this.

    (b) *Full Cost Pricing on Development*. Suppose new development had to pay their share of the full capital costs of public facilities required to serve it? This is equitable and efficient.

    (c) *Full Cost Pricing for Travelers*. Suppose travelers had to pay for the pollution they produce and the congestion they impose on others? They would travel more efficiently, better use infrastructure, be less peaked.

    (d) *Capturing the Benefits*. Suppose infrastructure providers could capture the land appreciation that results from their investments. There would be more investment.

Are these things difficult?

Yes, and that is why you are paid the 'big money,' to make difficult decisions. These are worthwhile things, that will improve the efficiency of the region, lower costs, enhance services, upgrade the experience of users, and reduce both failures and the consequences of failures.

30
First, Do No Harm

Figure 30.1: Berlin Wall remnant, 2003. The Wall was as bad as any US urban renewal programs in the damage rent to Berlin. 14 years after its destruction the area was recovering. Photo by author.

Originally published as Levinson, David (2013-03-25) First do no harm: Cities and infrastructure as living systems.

I swear by Apollo The Healer, by Asclepius, by Hygieia, by Panacea, and by all the Gods and Goddesses, making them my witnesses, that I will carry out, according to my ability and judgment, this oath and this indenture.

To hold my teacher in this art equal to my own parents; to make him partner in my livelihood; when he is in need of money to share mine with him; to consider his family as my own brothers, and to teach them this art, if they want to learn it, without fee or indenture;

> to impart precept, oral instruction, and all other instruction to my own sons, the sons of my teacher, and to indentured pupils who have taken the physician's oath, but to nobody else.
>
> I will use treatment to help the sick according to my ability and judgment, but never with a view to injury and wrong-doing. Neither will I administer a poison to anybody when asked to do so, nor will I suggest such a course. Similarly I will not give to a woman a pessary to cause abortion. But I will keep pure and holy both my life and my art. I will not use the knife, not even, verily, on sufferers from stone, but I will give place to such as are craftsmen therein.
>
> Into whatsoever houses I enter, I will enter to help the sick, and I will abstain from all intentional wrong-doing and harm, especially from abusing the bodies of man or woman, bond or free. And whatsoever I shall see or hear in the course of my profession, as well as outside my profession in my intercourse with men, if it be what should not be published abroad, I will never divulge, holding such things to be holy secrets.
>
> Now if I carry out this oath, and break it not, may I gain for ever reputation among all men for my life and for my art; but if I transgress it and forswear myself, may the opposite befall me.[1]

[1] (Hippocrates of Cos, 1923).

WE SHOULD ACT AS IF CITIES, AND THE INFRASTRUCTURE NETWORKS THAT BIND THEM, ARE ALIVE.[2]

[2] To the immortal question of George Harrison: What is Life? Wikipedia says:

> Life (cf. biota) is a characteristic that distinguishes objects that have signaling and self-sustaining processes from those that do not, either because such functions have ceased (death), or else because they lack such functions and are classified as inanimate. Biology is the science concerned with the study of life.
>
> Any contiguous living system is called an organism. Organisms undergo metabolism, maintain homeostasis, possess a capacity to grow, respond to stimuli, reproduce and, through natural selection, adapt to their environment in successive generations. More complex living organisms can communicate through various means.

When we realize that surgeons didn't know to wash their hands before seeing a patient (or worse, between patients) until the middle of the 19th century, though of course midwives did know, we are appalled with the medical practices of the past. Yet we expect the future will be appalled with us. As Dr. Leonard McCoy (Bones) said in 1986's *Star Trek IV: The Voyage Home*:

> "My God man, drilling holes in his head is not the answer! The artery must be repaired! Now, put away your butcher's knives and let me save this patient before it's too late!"

and later, referring to Kidney Dialysis, exclaims:

> "What is this, the Dark Ages?"

The city planner and transport engineers of today, among other professions, similarly act upon an existing city the way a physician might act upon a body. But just as today we are appalled by the medical practices of a century ago, we are also appalled by the planning practices of half-a-century ago. We are always of our time, and the standards of good care change over time.

The city has often been likened to an organism, with downtown representing the control functions of the brain and transport networks its arteries. This is often quite literal, 'arterial' is the term of art for important roads, smaller roads are less frequently referred to as capillaries. Scientists have examined the city's 'metabolism'.[3]

[3] (Samaniego and Moses, 2008).

The better analogy is probably that of the superorganism. Cities contain many individual organisms, the most relevant of which are us humans. Like an ant colony, a city and its infrastructure persist over time, taking in and sending out resources. The city grows (or dies) and occasionally sends off spores to form a colony, which may become a new metropole.

MONEY IN THE URBAN ECONOMY IS ANALOGOUS TO THE ENERGY AND FOOD SUPPLIES NEEDED BY MORE CONVENTIONAL LIFE FORMS. The more trade, the larger the city can grow. And like a tree which grows up and out, with a rotted core, the same often happens to cities. Interaction with the outside world, the source of energy or economic resources, takes place at the boundaries of an organism. The super-organism may eventually decide it doesn't need the inside or finds that is best used for storage. Or it may rediscover its abandoned areas. The tension between agglomeration and external trade is resolved in different ways in different places.

We also talk about the lifecycle of technologies, from birth, to growth, to maturity, to decline, analogizing technologies to living organisms. Individual deployments of those technologies may follow similar lifecycles.

The production function of living systems combines fixed and variable costs. As a homeowner we may plant a tree. But if we don't take care of the tree, its likelihood of long-term success is low. So we maintain it. We prune it. We water it. We protect from bugs, and so on. We don't set it and forget it about trees, nor should we about infrastructure.

We need to think about the lifecycle of buildings and infrastructures. Eventually they fail or we realize they are going to fail, or we might want to replace them because they are functionally obsolete. To keep them alive we need to monitor, maintain, repair, and eventually rebuild these systems, alternatively we might just abandon them.

EPIDEMIOLOGY STUDIES THE STATE OF HUMAN HEALTH, AS MEASURED BY THE PRESENCE OR ABSENCE OF DISEASE, AS WELL AS THE CAUSES OF THOSE DISEASES, WHETHER GENETIC, BEHAVIORAL, OR ENVIRONMENT. Someone should similarly be responsible for studying and treating the state of urban health, focusing upon the city's circulatory system, and looking at causes including human behavior and the urban environment (which is usually taken as fixed) in which humans interact. As knowledge from epidemiology leads to treatments by doctors prescribing

medicine, nutritionists telling the patient to change his habits, environmental engineers ensuring clean water, or regulators changing environmental standards, knowledge from transport leads to treatments by traffic engineers prescribing angioplasty for the hardened arterials of our city, planners building bypasses, or gurus telling us to change our behavior or urban environment.

There is at least one useful lesson from medicine: *First do no harm*. We would not want a surgeon to chop off our arm, and leave a gaping hole for a few decades while he figured out what to do next. We should consider why we destroy functional parts of cities well before we have any plan or resources to close the gaping wound with something else functional. Urban doctors need to require replacement by something other than a vacant lot or surface parking before they permit demolition.

Instead of viewing cities as inorganic discrete objects, we should think about the city as a holistic superorganism: where changes to one component have effects on many others, and where decisions now shape the choices available later. Thinking this way discourages actions that destroy without immediately creating more access than they replace. [4]

[4] To end this book with an equation, which have thus far been studiously avoided, I will provide this for the mathematically inclined. Access should not simply maximized for a hypothetical end state. Instead think about maximizing the integral over time of Access. Add whatever weighting functions you like.

$$Max\, z = \int_t Access(t)$$

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